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PAPERS

OF

SURGERY, PATHOLOGY

AND

ALLIED SUBJECTS.

BY

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LONDON;

PRINTED BY

ADLARD & SON, BARTHOLOMEW CLOSE.

1889.

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DEDICATED
TO
MY OLD FRIENDS
WHO WERE STUDENTS AT ST. THOMAS'S HOSPITAL
DURING THE FORTY-THREE YEARS
THAT I WAS A TEACHER
AS WELL AS A LEARNER IN THE SCHOOL.



PREFACE.

THE scattered papers which constitute this volume have been collected chiefly for distribution among a few of the Author's old pupils and personal friends.

The papers entitled "Surgical Reminiscences" were contributed in successive years to the 'St. Thomas's Hospital Reports,' extra copies being printed for the author, with the design of their future embodiment in the present volume. Hence the repetition of the headings to each paper.

The "Introduction" was an after-thought.

No claim is made for the book, beyond that of its containing a record of the opinions and experience of the author on the subjects of which it treats.

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INTRODUCTION.

It has been suggested to me that a brief review of the progress of Surgery, since I commenced my professional studies more than sixty years ago, may be acceptable to my readers. The few of my contemporaries who remain will recognise the contrast of the past with the present; whilst my younger brethren may probably wonder how, with our many disadvantages, we managed to get along as well as we did. But at that time good seed was being sown, in the form of original observations and valuable monographs, which has since borne rich fruit; for many of the writers were philosophic thinkers: the present generation are reaping the benefit.

The distant period and the circumstances to which I refer seem to myself, sometimes, almost mythical; at others they seem so near, that it is difficult to realise that considerably more than half a century has elapsed since I began to play a part in the scene. One of my earliest experiences was that of crossing the old London Bridge from my father's residence in the City, to attend, in the evening, the surgical lectures of Joseph Henry Green, who was then thirty-six years of age, and in the zenith of his reputation for unsurpassed eloquence. Often have I stood and listened, with some degree of awe, to the roar of the tide, as it rushed through the waterworks beneath the arches of the old bridge. This was a time when London was ill-lighted and worse protected; for the watch-

men who called the hour by night were the only police the City then possessed. Omnibuses and cabs and lucifer matches were not invented ; and steam traffic was still in its infancy either by land or water, though coach travelling had attained its maximum speed of ten miles an hour. The penny postage had not been thought of, and correspondence was an expensive luxury.

I became an articled pupil of Mr. Travers, Senior Surgeon to St. Thomas's, at the beginning of the year after the separation of the Borough schools ; *i.e.* in 1827. This was some years before the additional wards were built, and whilst the old Hospital retained its antique character and squares, the aspect of which the new bridge changed. The medical and surgical cases were then mixed ; and three wards were appropriated to the male, and one to the female venereal cases : these were named "the foul wards." At this time the staff consisted of three physicians and three surgeons : there were neither assistant nor house officers, except the Apothecary. The surgeons at St. Thomas's were Travers, Green and Tyrrell, and at Guy's, Key, Morgan, and Bransby Cooper and Callaway ; all former pupils of Sir Astley Cooper, except Green, who was articled to his uncle, the elder Cline. Though the schools were separated, the students had the privilege of attending the practice of both hospitals. Mr. Grainger's private school was then well supported.

The apprenticeship system was still prevalent in the Hospital ; and, in the Borough at least, it was understood that the apprentices had the first, if not the exclusive, claim to succeed to the surgeoncy, when vacancies occurred. It is difficult to defend this special privilege, yet it was not without its recommendations. There were generally several apprentices to compete ; and their long hospital experience, derived from their protracted dresserships, as well as the arduous work required of those who hoped to succeed, constituted exceptional qualifications for the office. Certainly the surgical staff of

both the Borough Hospitals at that time justified the practice. The appointment of Assistant Demonstrator was the first round of the ladder that had to be climbed; and as the duties of this office were very exacting, and were then performed gratuitously, the sacrifice was considerable both of time and health, as I learned to my cost; for more than ten years elapsed before I was promoted to the Assistant Surgeoncy. The first prize was not given till after I joined the school, when the Cheselden Medal was founded for Anatomy and Surgery. The Dresserships were paid for, and were valued accordingly; for the responsibility attaching to the Dresser was then much greater than since the appointment of assistant and house surgeons.

The hospital wards and operating theatres were miserably lighted; and I have often operated for hernia or the ligature of an artery, with the tallow of a solitary candle dropping around or into the wound.

It is difficult now to realise the contrast between the nursing of that day and of the present. Many of the sisters were respectable elderly women, but in most instances quite unfitted, in intelligence, activity and sympathy, for the position they occupied. Some had grown old in the service, and were too infirm for any efficient supervision: others indulged too freely in the creature comforts. The nurses were an inferior class, selected rather for their capacity in manual labour than for any other element of fitness. The change to the existing arrangement is indeed a blessed one, and worthy to occupy the foremost rank among the privileges possessed by hospital surgeons,—indeed by all practitioners, private as well as public, in the present day.

As regards the general apprenticeship system, which has now become obsolete, I cannot help expressing my regret that so valuable an institution should have been abolished. This is not the first time I have recorded this opinion (see p. 417); for I am satisfied that the period which youths spent as ap-

prentices, if not absolutely wasted, was of incalculable value to them in preparing them to reap the utmost advantage from their sojourn at a London School and Hospital; and also in laying the foundation of practical experience and self-reliance which is felt through life. That our Candidates for license to practise at the present time have more science acquirements than formerly I admit, but in practical acquaintance with the details of their professional work—the importance of which must be conceded—they compare in my opinion, and considering their many advantages, unfavorably with their predecessors of half a century since. How few now are the opportunities for young men to learn dispensing! how many pass their time at a hospital without seeing, possibly, any of the infectious fevers, and the multitude of the minor ailments which are not treated in these institutions! It is true that clinical teaching is, or ought to be, more systematic now than formerly, but it was far from defective in our hospital, when I acted as clinical clerk to Drs. Elliotson and Roots. Science exacts much of its disciples; and its advance in the special subjects of his study taxes the student of the present day beyond his power, to the neglect of the practical application of his acquired knowledge. He wants less of theoretical and more of applied science, as he is apt to realise when he commences practice on his own account, or seeks for an appointment as an assistant. In preliminary education, scientific acquirements and general conduct, the students of the present day are, as a class, in advance of my contemporaries; and if they be in a position to avail themselves of these advantages there can be no doubt that they have a better foundation on which to build than those who preceded them. But I fear that the requirements of general practice are, in most instances, too importunate to admit the claims of science. Could not some middle course be adopted, by which every student should be required to have spent a year with a qualified practitioner, to learn dispensing, and to familiarise him-

self with some of the details of that which will constitute so large a share of his future professional life ?

Of the present tendency of anatomical teaching I am not a competent judge, as many years have elapsed since I took any share in it. But I well remember that the best way to make anatomical lectures attractive was, to give a practical application to the subject under discussion : and I never had so attentive a class as when I lectured exclusively on regional and surgical anatomy. When I commenced my studies Physiology could scarcely be called a science, and Histology was limited to a few facts and observations. Indeed, when I was first appointed to the Anatomical chair, I was required to include Physiology and General Anatomy—as the science of texture was then termed—in the course which I gave. The subsequent strides of these branches of science necessarily gave an impetus to Pathology and Surgery : and the living tissue was subjected to experiment and observation, which laid the foundation of the present inclusive science of biology. Notably may be mentioned the identification of nerve-function with its sources, and the cell-theory of reproduction and growth. The great discoveries of the convertibility and conservation of Force, and of Evolution, may not be forgotten as having had an indirect influence on allied branches of science.

It would be vain, in this brief review, to attempt even an enumeration of the various directions in which Physiology has advanced : some of the salient points only can be noticed. Notwithstanding the efforts of experimenters to show that life may be generated by the agency of chemical and physical forces, the axiom “*omne vivum à vivo, omne ovum ab ovo*” is still the accepted doctrine. Life is an endowment, transmissible, but outside the sphere of spontaneous generation. The general use of the microscope, and the great improvement of this instrument, have been chiefly conducive to this pro-

gress ; for the study of minute structure must precede that of function. The cell-theory in development, to which allusion has been made, was due chiefly to the labours of Schwann, Henlé, Schleiden and Barry, and still maintains its value. Embryology is a new branch of the science : in the learned and interesting lectures of Dr. Blundell, which I attended, this subject was dismissed with a comparatively brief notice. The structure of glands was very imperfectly understood till Kiernan's investigations were published, on the ultimate distribution of the hepatic vessels. The muscularity of arteries was not recognised by Müller of Berlin, who was the Professor of Physiology when I was at that university, and the first authority of his day. Schwann noticed the contraction of the arteries in the mesentery of a frog, on the application of cold ; but he and Müller attributed this property to a special *tonus* in the elastic tissue. Yet how wonderfully has the recognition of the muscularity in the smaller arteries, and the superintending influence of the vaso-motor nerves, aided in interpreting many pathological as well as physiological phenomena, which were otherwise unintelligible or incorrectly explained ! The structure of muscle had been imperfectly investigated, and its ultimate fibrils had not been examined, until Sir W. Bowman took an active part in their display. The earlier discoveries of nerve-function owe much to Sir C. Bell and Dr. Marshall Hall. The former identified, experimentally, the respective functions of the anterior and posterior roots of the compound nerves ; and the latter, in like manner, demonstrated the excito-motor or reflex function of the cord. Much has since been done, by observation and experiment, in localising the functions of the brain. The great progress made in organic chemistry has been of material assistance in advancing physiology, as well as in the treatment of disease.

Mechanical rest was fully appreciated, and possibly more rigidly practised, in my early career, than at the present time. But more attention has been given of late years to physio-

logical rest, as taught in the excellent lectures of Mr. Hilton, delivered at the College of Surgeons. This subject probably acquires more importance from the changed conditions of life in which we are now placed. Indeed, these changes have been so many and great within my memory, that I find it difficult to trace the relation of cause and effect, if there be any, in the various circumstances which come under the notice of the medical practitioner.

“Tempora mutantur, nos et mutamur in illis”

is the expression of a fact, but it offers no explanation of its truth. Why has the treatment of acute inflammatory attacks so completely veered round, that *V. S. ad deliquium* and mercury have given place to support and stimulants? So common was the practice of blood-letting at the time to which I refer, that it used to be undertaken for the most trivial reason, or without any at all, at the request of a patient. It was the Dresser's duty to follow the Physician after his visits to the wards, with a bundle of bleeding orders in his hand. Now probably not one candidate in fifty for the College diploma has ever bled a patient. Yet patients used to recover under this antiphlogistic treatment,—perhaps, it may be said, in spite of it. Setons, issues and moxas were very commonly used at that time: now they are almost discarded; and even open blisters are more rarely employed. I suppose the dread of germ-infection may partly account for the disuse of drains and counter-irritants, from which I have seen much benefit accrue in well-selected cases.

At present medicine is used with more knowledge of its effects, and many new and valuable remedies—especially such sedatives as chloral and the Bromides—have been added to the pharmacopœia: in addition to which the subcutaneous injection of many remedies, including anodynes, has been found a ready and efficient mode of administering them. Yet I think too much confidence is still placed in medicinal treatment; and that the indications of nature are thereby not in-

frequently interfered with prejudicially. It must be admitted that the administration of physic is less profuse now than formerly : and this is probably not a little due to homœopathy, which has taught us how much is done naturally, without medicine.

The germ theory in pathology has led to a more careful investigation of the parasitic origin of disease generally, of the presence of microbes in the blood, lymphatics and areolar tissue, and the intercommunicability of infection between man and the lower animals. Fresh examples are now recorded, in addition to those previously recognised, of disease being thus propagated ; notably the wool-sorter's disease generating splenic fever in animals, and anthrax in man. It has also been established that tubercle is communicable ; and diphtheria and scarlatina are derivable from the cow, apparently through the milk. The communicability of rabies has, of course, long been known, though the discovery of its true pathology is of only very recent date : and I remember examining the body of a patient of Dr Elliotson, who died of glanders, resulting from an abrasion on his hand being poisoned, when grooming a glandered horse.

Pasteur and others have availed themselves of the information derived from these sources, in "cultivating" the infected matter so as to produce, by inoculation with it, a milder form of the disease, and thus secure immunity from the severer attack. M. Pasteur's success in this treatment of rabies (which I recently witnessed at his Institute) seems to justify his anticipations, judging by the statistics which have been published on the subject, with his sanction. If pathological development can be thus controlled, and if disease can be thus modified by progressive steps, is it unreasonable to suppose that disease generally, in its more intense and virulent forms, is the product of progressive evolution from some simple initial type, influenced by inheritance, environment, and intrinsic tendencies ? But this subject need not be pursued

here, as it is discussed in a paper specially devoted to it in this volume.

The multiplication of surgical implements at the present time is in singular contrast with the few and almost primitive instruments in use in my early days. I suppose this may be, in a measure, ascribed to the greater diversity and complexity of operations now performed, with the aid of anæsthetics. Nevertheless, it must be admitted that the assistance which the surgeon derives from mechanism and instruments of precision is both varied and valuable. Esmarch's bandage is a simple but efficient means of controlling hæmorrhage in protracted operations on the limbs. Drainage tubes are now very popular: my own experience of them is that, though sometimes useful, they are often mischievous, by producing irritation, and keeping open wounds which are disposed to heal. Fine wire has been substituted, in many instances with advantage, for silk sutures; whilst torsion often supersedes the ligature in the arrest of hæmorrhage. Probably the most valuable discovery of this class is the short ligature of animal tissue, if we can feel secure of its retaining its hold sufficiently long. It is a great advantage to be able to close a wound when an artery is tied in its continuity: if this plan had been adopted in a case of axillary aneurism in which I tied the subclavian artery, the patient would, in all probability, have been saved. I speak, however, without practical experience of this method.

Tracheotomy has become a generally accepted and common operation within my memory. The double tube is greatly to be commended, as much risk is incurred in the removal of a tube by an unskilled hand. I remember losing a case in this way, the tube having been removed for the purpose of cleaning it, and subsequently introduced by the side of the trachea.

The treatment of fracture was, formerly, almost uniform and simple, the only contending principles being that of coercion, in straight splints, by extension; and that of humouring

the muscles as far as possible by relaxing them, which I have always thought both more reasonable, as a rule, and more successful. Certainly the treatment of fracture with starch or silicated bandages or felt splints, or plaster of Paris, is a valuable adjunct to this branch of surgery; but their use requires experience and careful supervision. The approximation of the fragments of a fractured patella by hooks or suture I have never adopted, being satisfied with the old method, if persevered in for a sufficient time. Premature liberty is a usual cause of failure, by permitting undue extension of the fibrous union. Is direct union desirable? It may entail inequality at the seat of fracture. A greater triumph in surgery is the discarding of all mechanical aid in the reduction of dislocation. I need not say that the pulleys, with occasional blood-letting and tartar emetic are within my recollection. Now the manipulation for the reduction of dislocations, even of the hip-joint, is, with an anæsthetic, simple and comparatively easy. This important step in surgery is due to Dr. Bigelow of America.

Deformities, especially of the legs and feet, which were formerly thought incurable, have, within my memory, been remedied by mechanical treatment and operation. It was believed that a divided tendon, with a resulting interval between the cut extremities, would almost certainly remain ununited, until it was proved experimentally that this tissue rarely fails to join kindly under these circumstances.

Of the stethoscope it is unnecessary to speak. It was used only by the few when I first began my clinical work, and it is a source of wonder now how diseases of the chest could be diagnosed and treated successfully without it. By slow degrees only has its utility been fully developed by patient and trained attention. But there are many other "scopes" which are now available in diagnosis and treatment. The laryngoscope is regarded as essential to the practitioner, who may be called upon to deal with accident or disease of the

throat, threatening life. The ophthalmoscope is necessary to every ophthalmic surgeon. The endoscope will, no doubt, be rendered more useful as it is more employed,—especially in examining the bladder, now that the electric light is available for that purpose. The sphygmograph is an instrument of precision, which may be serviceable in special cases, though the trained sense of touch is preferable in most instances. But, of all these instruments, the clinical thermometer is probably the most valuable and that chiefly depended on. Yet reliance on it may be deceptive, if the temperature be taken only at long intervals; and herein is an exemplification of the advantage of having trained and intelligent nurses, who may be trusted with this and similar observations, during the intervals of visiting a patient, which assist so materially in the diagnosis and treatment of disease.

Electricity is now utilised in various ways, both in diagnosis and treatment. It is made the means of rousing torpid muscles, and of invigorating them by restoring deficient nerve-energy, and its value is also elicited in testing the mobility and sensibility of textures to which it is applied. Its utility for illumination and for the rapid concentration of intense heat, when the actual cautery is required, is also recognised by surgeons.

The art of photography has been usefully employed in perpetuating the representation of characteristic deformities and other pathological conditions, and in the contrasts before and after operations. I can well remember the surprise and pleasure with which the first Daguerrotypes were hailed; and I still possess some of these primitive plates, representing cases on which I had operated. But this process yielded, after a time, to the more satisfactory delineations of the present day.

But other discoveries have had a more direct influence in promoting practical surgery: I refer to the employment of anæsthetics; and the application of the germ-theory of disease

to treatment by antiseptics, in which Sir Joseph Lister has taken so leading a part. The earliest attempt at anæsthetic treatment during operation was by the local abstraction of heat which was accomplished with the aid of a bag containing pounded ice and salt. I first employed this, under Dr. Neil Arnott's instructions, and successfully, in superficial operations. The freezing of the skin is rapid and very sudden. Ether-spray is more manageable and equally effective. Cocaine seems now to have superseded both these agents, as a local anæsthetic. Certainly the inhalation of chloroform, or ether, is an almost unmixed boon to the patient. I say almost, because patients seem to suffer more and to experience other inconveniences, when they recover sensibility, than when no chloroform is given. This may be from disappointment on awaking to suffering in the one case, and to a sense of comparative relief when the operation is finished, in the other. Probably the greatest service to the patient is exemption from the anticipation of suffering, and the consequently quiescent state of the nervous system in approaching an operation. Whether anæsthetics are an unmixed advantage to the surgeon I venture to doubt. Formerly the unruliness of a patient could be readily controlled with sufficient assistance; and the attention of the operator was, or should have been, too much absorbed with his work, to allow of its being distracted by the patient's inevitable suffering. After a long experience in operating without an anæsthetic, and having witnessed fatal cases and nearly lost one patient myself from inhalation, I confess I have rarely been able to entirely dismiss the apprehension, during an operation with an anæsthetic, that some mischance might occur. But probably few of the present generation sympathise in this feeling. In cases where after-sickness is likely to be prejudicial, as in hernia, I generally tried to dissuade patients from inhaling.

The germ-theory of disease is certainly pregnant with great results; and all are ready to admit how much the field of in-

quiry has been enlarged, and with what valuable practical results it has been cultivated by M. Pasteur and his disciples. It has already borne much fruit; and the fear is not unnatural, in thoughtful and cautious minds, that the path of investigation may be contracted or diverted, by ascribing too much to this discovery, or by attributing to the germs themselves that which is really due to some property they have derived from a previous soil, or to some other and intrinsic cause. The value of antiseptics to the surgeon is chiefly associated with the dressing of wounds, the object in view being the exclusion or destruction of infecting germs, at the same time that free drainage is provided for. The former desideratum may be accomplished, in great measure at least, by scrupulous attention to cleanliness; and the latter precaution was not neglected before the new theory was promulgated, and the questionable employment of tubes, intended to facilitate drainage, was introduced. We always recognised the importance of excluding air from wounds, especially those communicating with closed sacs: but this was from the apprehension that decomposition was thus favoured: and my belief is that this chemical action, where there is imperfect drainage, and apart from the presence or multiplication of germs, may account for many cases of septicism. A practice which I frequently adopted was an apparent, but not real, deviation from this precaution. In amputations and other clean incised wounds, I sponged the surface with spirit and water or a weak solution of chloride of zinc, until the bleeding had ceased; and then accurately closing the wound with sutures, it was left exposed. The coagulation of albuminous oozing really hermetically sealed the wound, and healing by the first intention was not an infrequent result. In a septic atmosphere or in dealing with septic wounds, the value of antiseptics cannot be questioned: indeed it was long since recognised in the use of the chlorate of soda and similar disinfectants. The simple and cleanly dressing of wounds received full attention with

us sixty years ago, as well as sanitary arrangements, so far as our lights enabled us to fulfil the necessary requirements : for I remember being much surprised at the backward condition, in these respects, of the Paris hospitals in 1833. I am told that, in Gynæcological practice, a more scrupulous attention to cleanliness and the use of antiseptics has in great measure abolished puerperal septicism. Hospital gangrene, as described by the older writers, in its highly infectious form, must have been rare in our Hospital within my memory ; for I do not remember to have witnessed the disease as an epidemic spreading from patient to patient, and rapidly destructive of texture and fatal in its issue. Yet John Bell, in giving a graphic description of the disease, speaks of it as still rife in hospitals a few years previously. The “Swan-Alley” cases, mentioned in this volume, also presented many of its features, but did not seem to be contagious, though evidently due to insanitary causes. Instances of severe phlegmonous inflammation, accompanied by diffuse suppuration and sloughing from tension, were more common at an earlier period than at the latter part of my official duties at the hospital. Such cases were aggravated by previous insanitary conditions ; and if not treated early by free incision, or when operations were thus attacked, they not infrequently proved fatal. This form of inflammation was certainly communicable ; and I should have considered it unjustifiable to place any operation or open wound near to a patient thus affected. In this infecting characteristic these cases resemble hospital gangrene, but the diseases are not identical though they are thus allied.

It is difficult now to realise the condition of London, as regards its drainage and other sanitary arrangements, at the earlier part of this century. Sanitation is, indeed, a new science ; and its agency, apart from any special theory, in the prevention and cure of disease is almost incalculable. The improved value of life, notwithstanding the crowding of the population, bears testimony to the influence of attention to

hygienic laws. Probably means may be suggested, before another half century has passed, of utilising the impurities which now poison our rivers, and thus engender more serious consequences than are traced commonly to this cause.

The progress of Pathology has kept pace with that of Anatomy and Physiology. Carswell's coloured plates of morbid changes gave an impulse to this branch of Medicine ; and many worthy labourers in the same field have continued to add to our pathological stores, among whom my former colleagues, Sir J. Simon and Dr. Bristowe, occupy a prominent position. The teaching on the subject of Inflammation, *quoad* the actual pathological condition, was very scanty and unsatisfactory when I was a student ; and I well remember the genuine pleasure with which I watched, for the first time and with a good microscope, the stasis of the blood-corpuscles in the web of a frog's foot, when irritated. I recognised, in this, the starting-point from which all the subsequent phenomena proceeded, and by which they could be interpreted ;—the resolution by resumption of the circulation, and the sequences of transudation, suppuration or molecular death. I still regard as true the suggestion of Sir C. Bell, that there is a vital relation between the blood and its containing vessels. The vaso-motor influence over the muscular arterioles is a far-reaching agency, not only in inflammation, but in the numberless pathological changes springing therefrom or associated therewith. Leucocytes had not then been observed ; and of course their important functions and migratory habit were unknown. I remember that, when I was a clinical clerk, the diagnosis and successive stages of meningitis, pneumonia, and pericarditis were accurately observed and understood, though the treatment of these inflammations differed, in some important respects, from that of the present day.

The first appearance of cholera in 1832 was during the last year of my apprenticeship, and I had to take my turn, as

resident dresser, at the time it was most destructive. We had a shed fitted up in the front square of the hospital, where the patients were received and treated, though rarely saved. I remember that the dresser, who preceded me in residence, died after a few hours' illness, on the day that his week expired. Another fellow-student, with whom I played cricket on one afternoon, was dead before the following morning. It was indeed a scare, rendered tenfold more alarming by a paralysing sense of our ignorance of the disease, either as to its origin, nature, or treatment. This ought to have taught us more than it did, or more than was laid to heart; for as the plague died out, so the consternation subsided; and we lapsed into our previous apathy; so that I think I may say the profession were almost as little prepared for the second as for the first arrival of the disease. During this, the second epidemic, twenty years later, Dr. Burton of St. Thomas's, and Mr. Aston Key of Guy's, were among its victims. Since then we have become thoroughly acquainted with the laws which govern the diffusion of cholera, and have learned the simple but important lesson, that this and many allied diseases are preventable by removing the predisposing and exciting causes. An appreciation of this elementary truth has led to a careful study of these causes; and when they were understood the remedy was not far to seek. Typhus, typhoid, scarlatina, and other zymotic diseases belong to this category, of which filthy surroundings, personal uncleanness, and impure water are the chief promoters. In reviewing the past, my conviction is that we owe our improved hygiene mainly to the repeated visits of cholera; and the sacrifice of life—principally of the refuse of society—has thus been more than adjusted by our far-reaching sanitary reform.

Typhus and typhoid were almost interchangeable terms formerly; or rather, typhoid was considered to be, as its etymology denotes, something resembling, but not actually, typhus. Sir William Jenner's observations have demonstrated

the distinctness of the diseases. It is my impression that typhus was more common in my early time than now. Indeed, I believe that statistics confirm what we should expect from our improved sanitation, that zymotic diseases generally are less prevalent or fatal than formerly. The communication of scarlatina from the cow opens up an interesting field for speculation, as to the possibility of obtaining, by means of culture, a prophylactic, similar to vaccine, against this fatal disease. Milk, indeed, has been made responsible for many epidemics, as well as that prime necessary of life, water. Diphtheria is allied, as regards its origin, to the above diseases. The name is new, and the source of the infection was not recognised when the *Cyclopædia of Medicine* was published in 1835. The disease was then accurately described by Dr. Tweedie, under the title of *Angina membranacea maligna*. Its epidemic character was also spoken of, as well as its fatality in a large proportion of cases. There seems to be a special affinity, pathologically, between diphtheria and scarlatina.

It was during my early sojourn at the Hospital that Dr. Bright, of Guy's, was engaged in his researches which led to the description of the disease which is associated with his name. Since that time the condition of the urine has been more examined and analysed, for the sake of the revelations it could impart; of which the presence or absence of albumen has been regarded as an important element.

Pyæmia, which is a comparatively modern name, was ill-understood in my student life. I suppose that is why I can recall but few cases at that time which I can identify as pyæmic. But we have not made much progress in the treatment of this condition, though improved hygiene very materially diminishes the risk of its development.

The nomenclature of *Tumours* has been altered, and a more minute and accurate account of their structure has been given, with the aid of the microscope, since Baillie and Abernethy

attempted their classification and description at the beginning of the century. The most scientific division is that adopted by Virchow, into those tumours, regarded conventionally as such, which are derived from the blood by exudation or extravasation ; and those which are due to proliferation of a single organic texture, or a combination of many organic structures. These two classes admit, of course, of many subdivisions. For surgical purposes, the classification according to structure is more convenient, and generally employed. As regards the practical pathology and treatment of either the simple or malignant class, I am not aware of any important advance, unless it be in the substitution of iodine for mercury, both medicinally and as a local application. Latterly I saw less of the encephaloid and colloid forms of cancer than formerly ; but this may be accidental. This disease continues to defy all researches respecting its origin and treatment. Its diagnosis, with the aid of the microscope, we have learned more accurately, after many years of careful study ; and we have also had impressed upon us the necessity of paying greater attention to the entire abstraction of every surrounding texture which is capable of harbouring any element of the disease ; but this seems to be the limit of our present knowledge of, or our ability to cope with, this fearful scourge. Cancer is a misplaced deposit or perverted growth of redundant material in an organ willing to receive it. What promotes the growth of this spoiled epithelium, which is produced in such excess, and what is the condition of the organ which thus accepts if it does not invite this deposition ? Answers to these questions will carry us a long way towards the solution of the problem. Cancer selects, in preference, for its primary growth, an epithelial texture. How is this accumulation of epithelium to be controlled or diverted ? We shall probably reach an explanation of the pathological origin of this disease through a physiological channel ; but this may leave us as far as ever from the discovery of a controlling or curative remedy, other than its

extirpation with the knife. Youthful energy and patient investigation cannot be more usefully employed than in this research; and I am hopeful that the rising generation will not have passed away before they are rewarded.¹

Tubercle, which plays an important part in surgical diseases, has received much notice latterly, and has been the subject of careful examination and experiment. Tubercle is now admitted to be a living growth; and the practicability of developing it in confinement in a vicious atmosphere, with insanitary surroundings, has been proved satisfactorily: and the association of this circumstance with the recognised presence of a special bacillus is remarkable, as it is suggestive of the transmutation of some innocent germ into the microbe specially identified with, and capable of conveying the infection of, tubercle. Certainly there is the alternative hypothesis, that there are homeless germs, wandering in search of a suitable soil in which to thrive and multiply. These lessons inculcate the value of preventive measures, but do not help us much in the treatment of the disease when established. What we want is a germicide, and to learn how to employ it without injury to the patient. Can electricity be made available for this purpose?

I scarcely know what to say about *Syphilis*. A great deal has been written on the subject, and tertiary symptoms have been invented since I began my career, at the early part of which the Iodide of Potassium began to be employed for the secondary form of the disease. The investigations respecting inherited syphilis have been productive of some valuable and interesting results; but I am not aware of any important pathological revelations, except as regards the remoter and more general diffusion of the disease, or of advance in its successful treatment, during the last half century. The accepted doctrines of the present day are very much those which were formerly acted on by enlightened surgeons.

¹ Abernethy says that there existed in his time a society for the investigation of cancer. Why should not this be revived?

The treatment of *Aneurism* has undergone considerable change. Formerly the ligature was the only reliable remedy. Where practicable the clamp was first substituted; and this was succeeded by digital pressure, and, in popliteal aneurism, by forced and continuous flexion of the knee. Nevertheless, the ligature cannot be discarded; it was usually successful and sure: and there are many cases in which it is more appropriate, and certainly less painful, than pressure. Electricity has been advocated; and the introduction of coils of fine wire has been employed with some success in aortic aneurism. I may remark, incidentally, that I assisted Mr. South when he tied the aorta just above its bifurcation, though I did not approve of the operation, because I thought the iliac sound enough to take the ligature; but my advice was overruled. I once dissected a subject in which the aorta was obliterated just below its arch: but this had been a slowly developed obstruction, permitting of the gradual and progressive re-establishment of the circulation. The treatment of varicose veins has not varied much within my memory.

When I was clinical clerk to Dr. Elliotson, it was his custom to treat cases of neuralgia—especially sciatica—by acupuncture; and I have still by me some of the needles, with shields, which it was my business to introduce to the depth of an inch or more in a fleshy part, and to leave *in situ* for an hour or two. I mention this because I was shown recently an instrument specially contrived for acupuncture in similar cases. Nerve-stretching is a modern operation for these painful affections. Such a proceeding is rendered practicable by anæsthetics: how far the results justify the means employed I have not lately heard. The tenacity of a living nerve, as tested by experiment, certainly exceeds what I should have expected. Another safer as well as bloodless mode of stretching the sciatic nerve is by flexion of the thigh on the pelvis, and subsequent forced extension of the leg. I have tried this with some relief in sciatica. The union, by operation, of

a long-severed nerve, even with loss of texture, and the consequent restoration of its function, is fraught with deep interest, not only to the surgeon, but to the Physiologist also.

Among newly-observed diseases within my memory, besides Bright's disease already alluded to, in which there is progressive disorganisation of the kidney, may be noticed Addison's disease, which consists of tubercular infiltration of the suprarenal bodies, followed by an asthenic condition, which terminates fatally. Equally fatal also are the cases of lymphadenoma or Hodgkin's disease, in which there is extension of the morbid gland-tissue throughout the body;—a disease, therefore, which, from its intractability and destructive tendency, may be classed with the malignant group. I have now, under my notice, the case of a young woman, in whom this diffused hypertrophic growth has attained extraordinary development, and must soon destroy life. The anatomical association of aphasia with right hemiplegia and left cerebral lesion, has been shown, by Broca, to be limited to the posterior third of the third frontal convolution. This results usually from embolism, another morbid condition, the description and explanation of which is of comparatively recent date. It was, probably, a not infrequent cause of death before it was understood. Charcot's disease of the joints, associated with spinal disease, is comparatively novel; and so is the disease known as "osteitis deformans."

There can be no doubt that the extension of operative surgery, in late years, is due, in a measure, to the combined influence of anæsthetics and antiseptics. Surgeons have been encouraged by the success attending their boldness, and have achieved many things which a past generation would not have thought of undertaking.

Head and neck.—Ophthalmic surgery has made great advances in the direction of accurate diagnosis and acquaintance with disease, which is in great measure due to the

ophthalmoscope. Iridectomy in glaucoma, for which we are indebted to Sir W. Bowman, merits special mention. Excision of a spoiled eye, to secure the safety of the sound one, is of comparatively recent introduction: and I remember the early operations of dividing the internal rectus muscle for strabismus. The perfection to which artificial eyes have been brought leaves little to be desired in this respect.

The operation for cleft-palate has attained to great nicety and success, by division of the small muscles which act upon the velum pendulum. Tracheotomy, since its more general adoption in practice, has been employed, with varying success, in diphtheria and other diseases of the throat where obstruction exists, as well as for accident. This operation has also been found to aid in the spontaneous ejection of foreign bodies through the natural passage, by diminishing the sensibility of the glottis. Recently the introduction of a tube through the rima glottidis has been found a successful substitute for tracheotomy. The bold operation of excision of the entire larynx has been attended with success.

In dentistry that dreadful weapon, the key, has been wholly supplanted by the forceps. I shudder now when I recall the tooth-extracting practised in the hospital surgery, when I was in residence there. Drilling and stopping have been brought to great perfection; and artificial teeth are now employed in place of the natural teeth, which used, when I was first in charge of the dissecting-room, to be extracted from the young subjects which were brought for sale by the "resurrection men."

Aural surgery did not exist, sixty years ago, as a branch of scientific surgery: it was practised by ignorant professors. Whether our advance in acquaintance with the pathology of the ear is accompanied by corresponding progress in the successful treatment of deafness and other diseases I am not prepared to say. Some very delicate operations, such as the removal of exostoses from the aural meatus, have been suc-

cessfully performed; and this special branch of surgery is receiving the attention, due to it, of educated surgeons.

In cerebral surgery some important advances have been made. I am not aware that the treatment of fracture of the skull has varied essentially within my memory. I think, perhaps, that the trephine is used more frequently now than formerly, though not more than in Pott's time: but whether it is used more judiciously I am not prepared to say. It is a serious operation, with all its attendant risks, and not be undertaken lightly. A more accurate acquaintance with the functions of different parts of the brain has enabled surgeons to apply the trephine successfully in cerebral abscess and for sources of irritation indicated by the symptoms; and this is certainly a triumph of truly scientific surgery. We used to be more anxious about the reaction following concussion, when bleeding was in fashion: but this treatment has been long discontinued as a practice. I am not aware that the treatment of hydrocephalus by tapping has received any encouragement of late years. When I repeated the operation, some thirty years since, with an elastic band round the head, I was satisfied that no permanent benefit was likely to accrue from this treatment. In spinal bifida I have also found simple tapping unavailing: but other more extended operations, especially with the aid of injections, have been attended with more success.

It must be fifty years ago that Mr. Tyrrell conceived that there was sufficient analogy between injuries of the brain and those of the spinal cord, to justify a similar operation for the relief of both. He accordingly cut down on a crushed cord, removing the depressed fragments of the laminæ. This operation was subsequently repeated by Mr. South, but no good resulted in either case. The fact is that the extent of mischief in these cases is much more serious than in fracture of the skull, inasmuch as the greater part of the nerve-centre is usually spoiled beyond repair. It may be that a more accu-

rate diagnosis as to the nature and extent of the lesion may be rewarded with more success in future operations, if they be undertaken. But it should not be forgotten that where there is only partial compression of the cord, there is hope of some natural recovery. This same operation has, I understand, been successfully performed for the removal of tumours; and this is intelligible. The treatment of lateral curvature of the spine by suspension, and subsequent support with plaster-of-Paris jacket, was introduced by Dr. Sayre, and has been employed with advantage in suitable cases. Its use in angular curvature is more than questionable. Similar suspension has been employed for ataxy, but with doubtful advantage;—which is not to be wondered at.

Antiseptics have enabled the surgeon to deal more freely, and with more success, with such affections of the chest as require his interference. The case narrated at page 142 of this volume exemplifies this statement. The tapping of abscess in the lung has been successfully added to the operations in this region.

In Abdominal surgery the greatest advances have been made. Even exploratory operations were formerly regarded with dread; and were not deemed admissible until all other means had failed, as in intestinal obstruction: and thus the favorable opportunity of affording relief was usually delayed until too late. Now the exposure of the peritoneum excites but little apprehension; and the results which have attended various operations in this region justify the boldness which prompted the operators. It is superfluous to speak at length respecting Ovariectomy, which owes so large a share of its marvellous success to Sir Spencer Wells, and by which so many lives have been preserved. Yet, the adoption of such an operation, if discussed, was never seriously entertained when I was young. I may remark, by the way, that I once performed the Cæsarean section, in a private case, for Dr. Waller. The child survived, but the patient died of bron-

chitis, with a nearly healed wound and no peritonitis. Many years since I opened the stomach of a patient dying of cancer, with the advantage of relief from suffering; which is, I apprehend, all that is now usually contemplated in this operation. The removal of the pylorus for scirrhus has, however, been successfully performed. Colotomy may be required for permanent relief; but is justifiable if it be only for the relief of suffering. Recently opening the colon in the groin has been practised as a preferable operation; this I saw performed by Mr. Allingham, junr., successfully. I am not aware that any advance has been made in the treatment of strangulated hernia, except in the after management. Formerly, at St. Thomas's, calomel and opium used to be prescribed after these operations, to avert peritonitis. Now the calomel is dropped, and the bowel is kept at perfect rest to recover its tone. Operations for the permanent cure of hernia have met with encouraging success; and Mr. Wood is entitled to the merit of having brought this operation into notice. A case of ruptured small intestine from recent injury, with peritonitis, has been lately treated successfully by Mr. Croft. He found it necessary to excise a segment of the bowel, and united the cut ends by suture.

The surgery of the Urinary organs has made vast strides within my recollection. I remember Heurteloup exhibiting, in the operating theatre of St. Thomas's, his ingenious but clumsy apparatus for breaking a stone in the bladder by blows of a hammer; and I also recall the incredulity then expressed that success could attend any such attempt. It is needless to compare this scepticism with the realised operation of the present, which Sir H. Thompson has taken so prominent a part in perfecting. The final step of crushing and removing the stone at one sitting is due to Dr. Bigelow of America. The success which attended lithotomy in the hands of competent operators left little to be desired during the earlier part of the century; and I am not aware that any

improvement on Cheselden's lateral operation can be claimed. The supra-pubic section has come into notice, and may, in special cases, supersede the perineal method of gaining access to the bladder; in cases of large stone it is probably to be preferred. This operation is much facilitated by distention of the rectum. Tapping above the pubes for distended bladder is not a new operation; but it seems of late to have been more employed than formerly. Cystotomy, both perineal and supra-pubic, for the removal of tumours, is another and important advance in this branch of surgery. Patients, with ruptured bladder, are now no longer left to die without other than palliative treatment; laparotomy, for closure of the wound with suture, has been successful.

Contrary to earlier expectation, the kidney has proved amenable to rough handling: and not only have exploratory operations been performed in connexion with this organ, but it has been incised for abscess or the removal of stone, and even excised with success. Excision of the spleen for leucocythemia has been performed, but without encouraging result.

Many have been the operations suggested and practised, within my memory, for stricture of the urethra, by internal cutting (Stafford), by splitting (Holt), as well as by perineal section and caustic. Each may have its merits as adapted to special cases; but gradual dilatation still holds its own as the safest and most permanent treatment, where it is not impracticable. In the cure of hydrocele the injection of iodine, due to Sir Ranald Martin, is an important advance on the employment of port wine, which was used in my early days. Dieffenbach used to lay open the vaginal tunic and insert lint.

The operations on the Rectum have not varied much within my memory, with the exception of the bold excision of the bowel for cancer. Stricture is, I apprehend, still a troublesome affection, and hæmorrhoids are dealt with, as heretofore, by ligature, the knife or actual cautery. I believe the last-mentioned method is within my memory. Section of the skin

and mucous membrane, before the application of a ligature, saves the patient much pain. I think I am right in attributing the partial division of the sphincter for fissure of the anus to Copland Hutchinson. I learned the operation from Bransby Cooper, and have found the use of the knife unfailing. I cannot, therefore, appreciate the more barbarous method of tearing the fissure forcibly by introducing the thumbs into the bowel.

Although the essential features of limb and breast amputations remain unchanged during the last sixty years, many modifications and new methods have been suggested and practised, some of which have taken their place among the generally accepted operations in Surgery. Notably may be mentioned Syme's amputation at the ankle joint, and Pirogoff's modification of it, in which the posterior half of the os calcis is left, and brought into relation with the sawn base of the tibia. Various methods of incising the flaps, especially in the lower limb, have been devised; and amputation at the joints has been practised with advantage.

The substitution of joint-excision for amputation constitutes quite an era in surgery, for which the Profession owes much to Sir W. Fergusson. The larger joints have been repeatedly excised, and many limbs have been thereby saved. The free exploration of joints which is now indulged in has, no doubt, assisted materially in perfecting our knowledge of their diseases, to which the first important impulse in this country was given by the publication of Sir B. Brodie's work on the subject. Forcible rupture of joint adhesions, and section through the neck of the femur for deformed ankylosis, are further conquests in Surgery. Osteotomy near joints has also been practised with singular success. Knock-knee has thus been cured, either by sawing off the internal condyle, or by chiselling through the femur above the condyles. Where it has been practicable and desirable, in these and similar

operations, the periosteum has been carefully dissected off and preserved, that it might be utilised in the reproduction of bone.

Rheumatic arthritis has attracted more attention of late years, but I am not aware that any important progress has been made in its treatment. Charcot's disease, so named from the surgeon who first described it a few years since, is the association of some forms of joint-disease with locomotor ataxy. Very little seems to be known on the subject beyond this alliance; and there exists considerable diversity of opinion regarding the nature and origin of the disease.

Plastic Surgery does not seem to have made much, if any, progress, since I attended Dieffenbach's clinique in Berlin, more than fifty years ago. His was a master hand in this, as in most departments of operative surgery. Stromeyer was then also a great authority on this subject. Subcutaneous surgery has advanced, inasmuch as the need for it was scarcely recognised formerly. Tenotomy, for example, was not practised when Scott and Byron were living, or they might have been saved the mortification of lameness. Tendon-cutting has been practised in refractory fractures: but my own experience leads me to the conclusion that, except in rare cases, the operation does more harm than good. That the continuity of the true fibrous element, in a divided tendon, is re-established after a long interval I have verified by careful dissection. The subcutaneous section of contracted fascia in the palm or sole was practised many years since. Bone and muscle are now divided, and cicatrices are liberated in the same way. The practicability of skin-grafting was a remarkable discovery, and has been largely adopted; and the principle has been extended to other tissues, but not with similar success. The reunion of a divided nerve, even after a considerable interval, and accompanied by loss of texture, has been successful in restoring its function. Further, the union of the distal end of a divided nerve to another entire nerve has been followed

by the same result. I have seen neither of these remarkable operations.

It is difficult to obtain satisfactory statistics of the results of operations generally, so as to establish a comparison between the present and the past. There seems to be a general consensus of opinion that the fatality in hospital practice still exceeds that of cases which are treated in private, notwithstanding the improved sanitary conditions of our public institutions. There is no doubt that, under the most promising circumstances, the accumulation and contiguity of the sick is productive of a condition of atmosphere, unfavorable to the healing of wounds. A certain allowance must, however, be made, in instituting this comparison, for the antecedents of hospital patients, who are usually the denizens of large cities, and not, as a class, such favorable subjects for operation as those patients who are treated in private. The still larger question of the relative mortality of operations, whether in public or private, at the present date and fifty years since, is more complex than may at first sight appear. Judging by the statistics I have examined, and from my own observations, I should say that there is very little, if any, difference, in the long-recognised major operations. But in some new operations, notably in ovariectomy, the mortality has gradually diminished: and this is obviously due to the improved knowledge and increased skill of the operators, and the valuable assistance of trained nurses. In the category of long-established operations I include amputations, breast cases, lithotomy, tumours, ligature of arteries, hernia; and I venture to affirm, from such records as I possess, and from a long observation of the practice of my predecessors and colleagues, that these cases were treated as successfully fifty years since as now: I might say even more so in the frequent operation of lithotomy,—my predecessors at St. Thomas's rarely losing a case. Here again it must be admitted that there is the qualifying consideration, that the most un-

favorable cases—those in which the stone is large and hard,—are alone now subjected to the cutting operation. So, likewise, with respect to the ligature of arteries; many of the simpler cases are cured by compression. Notwithstanding these concessions it seems surprising that, with our boasted sanitary progress, our antiseptic precautions, and—probably most influential of all—our intelligent nursing, the rate of mortality remains much the same as it formerly was, in the operations mentioned. I am aware that this opinion is unsupported by such statistics as would impart value to it; and that surgeons of the present day would traverse my statement. I give it as my impression, and because it seems to me remarkable: possibly I may not stand alone among my contemporaries in this opinion. It is certainly more than probable that, if some of the modern operations had been undertaken without the employment of the appliances and precautions, of which modern enlightenment has taught us the value, the results would have been less favorable. Of these conditions, in addition to scrupulous cleanliness and good nursing, I regard seclusion, perfect rest, uniform temperature, regulation of the digestive organs, and attention to any special idiosyncrasy of the patient, as constituting the most important elements. I am afraid it must be admitted that, formerly, the pure surgeon was rarely a physician. It seems scarcely credible, yet it is a fact, that scarcely sixty years have passed, since the prescriptions of the surgeons at St. Thomas's had to be countersigned by the Physician before they were dispensed.

Many other instances may be cited, manifesting a conspicuous advance in the Profession, to which only a casual allusion can be made. Those unpretending but admirable institutions, the cottage hospitals, are now scattered throughout the country: the originator of them was Mr. Napper, an old St. Thomas's student. Medical officers are appointed in

every district, to compel people to take care of themselves and their neighbours. Ambulance work is taught everywhere, and readily available in case of need. Public analysts are appointed to control the adulteration of food, and to assist in the detection of crime. I think I may add that the Profession generally is held in greater esteem now than formerly;—probably because its value and importance are more appreciated, and, we may hope, also because its members are more highly educated and qualified. No doubt the introduction of natural science, as a branch of elementary and general education, has had an indirect influence in producing these results.

The treatment of drowned persons is regulated on more scientific principles since Marshall Hall introduced his new system of management. The methods now adopted, and perseverance in employing them, have, no doubt, saved many lives. The same remark applies to suspended animation resulting from anæsthetics. I can recall one remarkable case, in which I opened the trachea of a man *in articulo mortis*, who was revived after prolonged employment of Marshall Hall's method.

The treatment of the insane now is both more humane and more hopeful than formerly. When I first visited Bethlehem Hospital in my youth, restraint was still practised; now it is virtually abolished, save in rare cases, to the great benefit as well as comfort of the patients. Their cases, as a rule, are also in other respects better understood and treated. The honour of introducing these reforms is due to Dr. Conolly.

The subdivision of the Profession into special departments is a modern innovation of—to say the least—a questionable character. It is reasonable that operative ophthalmic surgery should be the particular province of educated surgeons; and the London Ophthalmic Hospital has nurtured many worthy representatives of this branch, amongst whom Mr. Travers and Mr. Tyrrell, both surgeons of St. Thomas's, are conspicuous examples, amongst my earliest recollections. I say

reasonable, because dexterity in operating on the eye can be acquired only by special practice and experience, and failure is necessarily attended by disaster, which is irremediable. In the acquisition of this special dexterity it is to be feared that the patient too often suffers. Aural surgery was, at the time alluded to, exclusively in the hands of pretenders; but is now, happily, made a branch of scientific surgery. Hospitals for various diseases have sprung into existence, under the inspiration and auspices of medical men, interested in the pursuit of some particular branch of medicine or surgery. No doubt they have generally proved profitable to the founders; and this innovation on older professional prejudices seems to have been accepted and fostered by the public,—a very common impression being that there are special doctors, not only for particular diseases, but for almost every organ in the body. Such exclusiveness in practice as is prevalent in the present day must be prejudicial to the scientific cultivation of surgery, and, I should imagine, of medicine also. It fosters the habit of trusting to precedent only, which often proves a frail reed to lean upon. It is not in the nature of things that a specialist can bring the same breadth of view and unbiassed mind to the examination of an intricate case, as he who has devoted equal attention to all branches of his profession. I could appreciate special asylums for the treatment of chronic diseases, or for varicose ulcers, which simply require regular and prolonged attention, and are an incubus on our public hospitals: but there is no excuse, on public grounds, for hospitals for the treatment of stone, of diseases of the rectum or of the throat, &c., which were, and still are, as well treated in our general hospitals as in these special establishments. The division of labour in our large schools is altogether a different question. It is a decided gain to the student to have the means of studying special diseases, and also to the teacher to have at hand the material for illustrating the subjects of his clinique: and I apprehend that this system has

become prevalent in our hospitals, in order to countervail the agency of the specialists, which tends to deprive them of these sources of clinical instruction and illustration. I need not say that, for obvious reasons, the foregoing remarks have no application to gynæcology as a special branch of medicine.

Another innovation of recent date—that of female doctors—is a delicate subject to be handled by an old man, who is willing to confess his prejudice in favour of old ways, and of the respective relation and duties of the sexes which are, happily, not yet obsolete. To those women who study medicine for the purpose of qualifying themselves as missionaries I sincerely wish God speed; especially when their efforts are directed to India, and the zenanas which are inaccessible to men.

In comparing the books and teaching of the present time with that of sixty years ago, a change commensurate with the general progress of medicine and surgery may be traced. The teaching formerly was simpler and more practical; there was more of the art and less of the science of Surgery taught. The same may be said of Anatomy; the broad features were well taught, but the minuter anatomy was less dwelt on: it cannot be made the subject of Demonstration to a class. Physiology could then scarcely be said to exist as a science.

The College examinations partook very much of the character of the teaching. They were brief and practical, but a very inefficient test of the competency of the candidates to engage in all branches of their profession. If the existing arrangements err at all, it is in the opposite extreme. The change is a salutary one, and tends to elevate the profession in public estimation. Our Manuals were few and scanty; suggestive rather than exhaustive, and not encumbered by illustrations, which are more often harmful than useful, and a lazy substitute for practical work. The monographs of Hunter, Pott, Abernethy and Astley Cooper, John Bell's Surgery, his brother's Anatomy, Travers' Constitutional Irritation and Diseases of the Eye, Brodie on the Joints, and

Lawrence on Hernia, were among the standard works then most read ; and S. Cooper's Dictionary of Surgery was used for consultation. Now, the "Systems" are legion. Are we more practical Surgeons than heretofore ? I must leave this question for others to answer.¹

The foregoing brief sketch of the progress of Surgery is necessarily imperfect in most details, and probably in not a few essentials. The interest which the retired practitioner may take in the progress of his profession scarcely compensates for the loss of active occupation ; and thus, ere long, he finds himself lagging behind.

This review naturally suggests the inquiry, What more can be expected of operative surgery ? It is a fruitless speculation. We have invaded the most sacred recesses of the body, and have freely handled their contents, cut into them, and removed some in their entirety. In accuracy of diagnosis and consequent appropriateness of treatment, and in the modification or correction of some of our accepted dogmas, we may hope that experience will gradually perfect that which has been begun. But it would be difficult to forecast any other direction, in which boldness, tempered by discretion, may find fresh fields to conquer. Yet there is much to be accomplished by the scientific surgeon in pathology, the pursuit of which will best repay him. Above all would I express the hope that my younger brethren may acquire early the habit of watching, learning from, and trusting to Nature. It is not the least valuable of the lessons which a long professional life has taught me, that the surgeon should be her humble handmaid ; ever ready to accept her suggestions and disposed to grant her petitions ; but rarely, and never hastily, to suppress or oppose them.

¹ For further remarks on this subject, see p. 198.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

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Lithotomy.—Hernia.—Caries.—Plastic surgery.—Of saving or sacrificing an injured limb.—Fissure of anus.—Ligature of arteries.—Ruptured bladder.—Primary and secondary amputation.—Nature of flap in amputation.—Trephining.—Fracture of base of skull.—Operations in general.—Exploratory operations.—Imperforate and artificial anus.—Exploration of rectum.—Excision of joints.—Dissecting wounds.

IN offering the following brief miscellaneous records for insertion in the 'Hospital Reports,' I wish it to be distinctly understood that I claim neither originality nor novelty for what I have written. I have narrated, I hope simply and intelligibly, what I have myself observed and done, and learned to trust and mistrust. In truth, I think it well that a hospital surgeon, at the close of his career, should contribute something towards the collective investigation and treatment of disease. Probably in some other instances, as in my own, the grains of wheat worth preserving may be but few; yet, in the aggregate, if all contributed, a valuable record of personal experience might be compiled, which would be not only of practical utility but valuable also for statistical purposes.

I am aware it may be urged that antiseptic surgery has, in many respects, recast or placed on a different footing the results of previous experience. It may be so; I cannot gain-

say what the present generation of surgeons holds as indisputable, whatever may be the verdict of the generation to come. But, long before this modern treatment of wounds was introduced, I had learned that the success of operations depends very much on the most scrupulous cleanliness and assiduous attention to what are too often regarded as minor details ; and I am free to confess that I attribute much of the success of the antiseptic method of treatment to the unremitting care exercised in these respects.

I may further acknowledge that a sense of obligation to my Alma Mater, where I was a learner for nearly half a century, would scarcely have outweighed my reluctance to undertake this task, were it not that I know my jottings will be read chiefly by my old pupils, among whom I reckon so many valued friends ; and I hope they may be thereby reminded of the many pleasant hours—I trust such to them as well as to myself—that we spent together in the wards and lecture-room of our old hospital.

Lithotomy.—My experience in lithotomy is limited in comparison with that of my immediate predecessors. Cases of stone were no longer sent up to London for operation as previously, but found their way to county hospitals, or were treated by competent provincial surgeons.

I have operated on about forty cases, with the loss of two patients ; and, singular to say, these were both children. One, a boy of three or four years old, never rallied from the effects of the chloroform which he inhaled, but died on the morning after the operation, having remained in a semi-comatose state in the interval. A post-mortem examination revealed no explanation of the cause of death, either from disease or the operation. The case was extremely simple and the stone small. This occurred soon after the introduction of chloroform. The other fatal case was of a boy, about ten years old. The existence of stone had been long known, but the operation was refused until the condition of the patient had reduced the chances of success almost to a minimum.

The oldest patient on whom I operated was aged seventy-four, the youngest twenty-two months old. The instruments I have used are a staff with a moderate curve of about three inches, and a rather broad scalpel, with a button point

which moved freely in the groove. I dare say the long curved staff has its advantages, especially in leaving the left hand at liberty to guide the knife. But, from habit, I prefer taking the staff into my own hand; the harmonious action of the two hands in the incision of the prostate, when acquired, seems to me to leave nothing to be desired. I was satisfied with the incision my scalpel made, and did not incise the prostate further. But one precaution I always took, which was to withdraw the knife slowly, with its edge pressed gently against the lower part of the wound, so as to secure entire division in this direction of every intervening filament of tissue which might interfere with free drainage, probably one of the most important precautions in the operation. I did not introduce a drainage tube, but allowed the urine to pass by the wound. A tube is required where it is necessary to plug the wound to arrest bleeding; but, except in this case, I regard it, as I do all foreign bodies in a wound, as prejudicial. The passage of the water over the incised surface helps to seal the open mouths of the vessels, and the healing process goes on without disturbance.

I may here remark, incidentally, that my practice in cases of extravasation of urine has been guided by the same principle, that of allowing drainage by the wound. A catheter may be useful in some exceptional instances; but until the healing process is considerably advanced I am satisfied the presence of a catheter is not only useless but positively injurious.

The stones I have removed by incision varied from five grains to a quarter of a pound.

In one instance only has the disease recurred, so far as I know, and this was in a patient who had previously been under my care for fractured pelvis with ruptured urethra. A year or two after his recovery—he was a railway guard—he presented himself with symptoms of stone. I cut him, and the stone—phosphatic—crumbled under the pressure of the forceps, like a mass of pure lime. Much care was taken by repeated washing of the bladder to remove every particle of the fragments, and he made a good recovery. But he again presented himself, and was again cut, a phosphatic stone, similar to the former, being removed with success.

The largest mulberry calculus I removed was from a young

man who had carried it as long as he could remember ; to suffer in his bladder seemed to him a normal condition of existence. He made a satisfactory recovery, and life became a new experience to him.

As regards the degree of suffering caused by different stones, I think more depends upon the condition of the bladder and its sensitiveness than upon the nature of the calculus. Certainly I have seen as much or more pain caused by a smooth than by a rough stone. Probably the sensitiveness of the mucous membrane is determined by the quantity and tenacity of the secretion poured out on its surface.

I have had some mishaps as, I presume, has happened to most operators. In one case only had I any alarming hæmorrhage, and this required continuous pressure on the pudic artery for some hours before it ceased. Troublesome venous bleeding in old men is not infrequent, but it has never caused me alarm.

In three of my cases a communication was established between the wound and the rectum. In one a large and hard lithic acid stone broke in the wound into two fragments, and the bowel was lacerated near to the anus. In the second case I was induced, by an ardent admirer of the long curved staff, to try this instrument which he held. I was foolish in forsaking the instrument I had so often proved, and I suspect I must have wounded the bowel with my knife in adopting this, to me, novel and tedious method of cutting into the bladder. Both these patients recovered without interference or subsequent inconvenience. In the third case I had to remove a stone, weighing three ounces, from a young man with a deformed pelvis, in whom the tuberosities of the ischia were very near together. The extraction of the stone took me longer than any that I have removed, for I never hasten this stage of the operation. This patient went on well until after the lapse of three or four days ; the water ceased to pass by the wound and he had a sharp rigor, followed by the bursting of a prostatic abscess. Shortly afterwards it was evident that there was a communication established between the wound and rectum, and this never closed. It was high up, as far as the finger could reach, and I have no doubt between the prostatic portion of the urethra and bowel. I

saw this patient frequently afterwards, and he made light of his trouble, speaking of it as only an inconvenience of little importance, I therefore did not attempt anything for his relief: the cautery was, indeed, the only remedy, and this it would have been almost impracticable to apply; moreover I did not know whether the communication was direct or tortuous, though I remember my impression was that it was indirect, and that I might do harm rather than good by interference.

I can recall but one instance in which I was unable to reach the bladder with my finger. It was in an elderly gentleman of tall stature, and with a very deep perineum. This is the only case in which I used the blunt gorget to direct my forceps into the bladder. The prostate was large and there were several small stones. Unfortunately I failed to remove all, for they had got into a sacculated portion of the bladder behind the prostate, and a portion of the gland came away in the blades of the forceps. After the lapse of a few days the patient's continued suffering induced me to suspect the truth; which I verified by a short sound passed into the bladder through the wound. Though a week had elapsed I found no difficulty in breaking down some deep adhesions in the wound by simply introducing my finger, and I thus removed two more calculi with a pair of small forceps. From this time he recovered without any further drawback, and suffered no inconvenience from the loss of a part of the prostate. The blunt gorget is a valuable instrument in lithotomy with a deep perineum; indeed, I think I should have used it more generally, if I had learnt earlier in life to appreciate its utility in directing the forceps and expanding the opening in the prostate.

I am not aware of any others mishaps to record, and I will finish what I have to say on this subject by a few general remarks. It does not appear to me that there is any essential improvement in lithotomy since Cheselden's time. I have never performed any but the lateral operation, and I have never had occasion to divide both lobes of the prostate, though I extended my incision, with a straight button-pointed bistoury, on two or three occasions during the extraction of the stone. I believe that success in the removal of a large stone

very much depends on the patience of the operator; irremediable mischief is occasioned by force, and there is even less excuse for haste now anæsthetics are used than in the earlier period of my practice. The yielding property of the prostate is well known, but its violent laceration may be fatal. I remember a conversation I had with Mr. Bransby Cooper before my first operation illustrative of this point. I was anxiously asking some questions relative to the operation, which he answered in his usual good-natured way, and his concluding words were these: "The incision your knife makes in entering the bladder will admit your finger, wherever your finger will pass your forceps will follow, and by the opening they make you can extract almost any stone." And I found these axioms practically correct, with rare exceptions, but then it was necessary to be patient where the stone exceeded a moderate size. In lithotomy, as in all operations consisting of several and independent steps, it is important to keep the mind fixed on each stage of the operation, without allowing it to be distracted by that which is to succeed. This may seem a very trite saying, yet I think it is not always attended to: cautious and deliberate action is far safer, though more time may be required; and this remark is applicable to the earlier steps of lithotomy as much as to the final one of withdrawing the stone. I adopted the use of a button-pointed scalpel, because I had known of more than one instance in which the bladder had been wounded by a sharp-pointed knife: the exchange of knives necessarily protracted the operation, but I gained in security. When I first operated I used the same scalpel throughout.

I have never had occasion to divide the sphincter and for inflammatory mischief and burrowing of pus in the wound; but I have no doubt about the desirability of laying the wound open into the bowel where this condition exists. In the after-treatment the position of the patient is important. The legs should be raised and separated, and the body so placed as to allow of ready drainage of the urine. A very early return of the water to its natural channel generally caused me uneasiness, yet this is often only a temporary condition.

Of lithotrity I have nothing to say worth recording. I have had but few cases, and in two instances have remove

larger stones than I ought to have attempted to extract by this method. I had miscalculated their size.

Lithotomy in the female.—I have never operated by cutting in the female but on one occasion, and that was in a child, about eight years old, the stone being as large as a walnut. This was many years since, when lithotrity was but little employed. I passed a straight narrow bistoury along a director into the bladder, and cut downwards and outwards as I withdrew the knife; in fact, in the same direction as in lithotomy in the male. I had no difficulty in extracting the stone, and no untoward symptom followed except that a considerable time elapsed before the child recovered entirely the power of retaining her water. I should now prefer crushing such a stone. I think rapid is preferable to slow dilatation, as there is less risk of incontinence from the former, so far as I have been able to judge.

Hernia.—I have often regretted that I did not keep an accurate record of all the cases of hernia in which I have operated: but in ordinary hospital practice they are of so frequent occurrence that they do not, at the time, seem to possess the interest or importance of rarer cases. Yet the recurrence of precisely similar conditions in consecutive operations is quite exceptional; indeed, I know of few instances in which an operation affords so much variety in its details, and therefore materials by which even the practised operator may extend his stock of experience. Given the material condition of early interference, I regard the operation for strangulated hernia as one which may be ranked amongst the most successful in surgery. I believe I have seen nearly every variety of strangulated hernial protrusion. The most dangerous are those of sudden descent resulting from violence; early operation can alone save them. Operations for umbilical rupture, especially if large, are attended with more risk than for the inguinal or femoral form.

The employment of the taxis requires tact and delicacy; the former can be acquired only by experience; without the latter infinitely more harm than good may be done. Rough manipulation, purgatives, and temporising delay account for a large percentage of the fatal cases of herniotomy. I attach very little value to any of the adjuncts to the taxis, which

involve delay. I have tried the warm bath, the local application of heat and cold, the administration of opium, but without much encouragement, and with the certainty that precious time is lost thereby. I have succeeded occasionally in reducing a hernia by raising a patient so as to place the pelvis considerably above the level of the shoulders. The principle is sound, being the substitution of traction by the weight of the viscera, for pressure on the limited surface of the rupture. But I believe the golden rule should be, to give a fair trial to the taxis, and if you fail, then to operate.

I generally have dissuaded my patients from taking chloroform, as the complication of after-sickness is serious. A simple straight incision over the neck of the tumour generally suffices; formerly it was the practice to divide the skin by a T-shaped incision, or by two incisions meeting at an angle.

Not infrequently some nodules of fat, external to the sac, so closely resemble omentum that they are likely to deceive the young operator. Intestine may generally be readily distinguished by the arborescent distribution of its vessels. For the division of the stricture I have employed a guarded knife, which likewise acts as a director.



I have operated subcutaneously, and also without opening the sac, in several instances. The former operation may be available in a few cases of very recent strangulation without urgent symptoms. The latter, except in such instances as those just referred to, I entirely discarded. I think the advantage supposed to pertain to this particular form of operation is imaginary; the fallacy consists in assuming that the condition of an inflamed hernial sac and of healthy peritoneum are identical. The fact is that though a healthy serous or synovial membrane is very susceptible under the influence of exposure to the air, they cease to be so when already in an inflamed or otherwise morbid state. So far as I can judge from my personal experience, opening the peritoneum forming

the sac of a strangulated rupture adds nothing to the risk of the operation, whereas there may be great peril in returning its contents without inspection: and surely the inflammatory product within the sac must be more prejudicial by contaminating the peritoneum than simple exposure of its interior, to say nothing of the after-drainage. It is very important, where the condition of the parts renders it probable that there will be a free discharge, to arrange that it shall not be retained or forced back into the abdominal cavity; as a choice of evils I would rather leave the wound unprotected save by a light poultice or water dressing than entirely block the opening.

The most careful search should be made in obscure cases: an old and adherent omental hernia may apparently fill the sac, without any unhealthy appearance to account for the urgency of the symptoms. But behind and hidden by it may be a very small knuckle of intestine, which is the seat of all the suffering. On more than one occasion I have operated and found nothing but healthy omentum in the sac, though the evidence of acute strangulation was present. I believe that in these cases a small knuckle of intestine had been strangulated, and returned possibly during the operation, as the neck of the sac by no means tightly grasped the omentum within it.

I think it is a safe axiom to act upon, that when in doubt it is right to operate. There is but small risk in operating unnecessarily, whereas your patient's life may be jeopardised by abstinence from interference.

I remember, during my apprenticeship at the hospital, it was the practice to give calomel and opium two or three times daily, commencing immediately after the operation; purgatives also were not infrequently administered far too soon. The dread of peritonitis prompted the calomel treatment; but I think that, of peritonitis pure and simple, patients rarely die: they sink from shock and protracted suffering, with vomiting and inanition;—no doubt associated with some peritonitis, but chiefly due to long strangulation, with the superadded misfortune of having been repeatedly and perhaps roughly handled and dosed with aperients.

The after-treatment should be of the simplest kind. Perfect rest, light dressing, free drainage where needed, only

such food as the stomach can take and digest comfortably, opium at intervals to keep the bowels perfectly quiet until the injured intestine has had time to recover; then, say after the lapse of at least four of five days, an enema may be administered of some simple kind to stimulate the lower bowel to act.

During treatment I have found that a sand-bag, which may be graduated at pleasure, forms the best support and protection against the re-descent of the hernia.

As regards age, the youngest patient on whom I have operated was an infant of eleven months, who had an acutely strangulated inguinal hernia, of course the congenital form. He made a quick recovery. I operated successfully on an old lady of eighty-four. But in another of ninety-one the operation had been delayed too long, the gut being gangrenous. She survived the operation eighteen days. The strangulation of congenital rupture is usually very acute.

Caries.—This condition in bones, which holds the same relation to necrosis as ulceration in soft parts does to gangrene, should be studied in this light with a view to its surgical management. The process of destruction is essentially the same as in ulceration of soft tissues, and that of repair differs only in the nature of the texture reproduced. These remarks are trite enough, but their application is in the inquiry whether the treatment ought not to be consistent with this parallel? I think it should in every respect, both general and local. Where practicable, free vent should be given to the discharge, whether during the destructive or reparative stage; and the living tissue should be stimulated to activity in throwing off the dead, and in accomplishing repair. In some cases, where large joints are attacked, this treatment cannot always be applied; but I think that in many instances free incision into even important joints may be practised with much advantage and without risk: for a diseased synovial membrane may be placed in the same category of insusceptibility as a diseased serous membrane. There is one form of treatment of carious bone which is generally advocated, but which I have rarely employed, because it is at variance with the principles I have referred to, and also, in my experience, is not productive of the good results ascribed

to it; I mean gouging. It seems to me as rational to expect a healthy surface to succeed a similar proceeding in an indolent or spreading ulcer. Surely, wherever the gouge is applied healthy cancellous tissue must be bruised and killed, and then an extension of the mischief must follow. It is in the tarsus that this rough handling most generally finds favour. I prefer a free external incision and dilatation of the bony sinus, removal of any dead fragments that may present themselves or may be loose in the cavity, and then the injection or constant application on lint of a solution which acts both as a stimulant and bone solvent.

It is a familiar fact that bone elements are found, in more or less abundance, in the discharge from a carious cavity. I assumed that phosphoric acid would be the best solvent of the inorganic constituents, but Dr. Bernays informed me that acetic acid is preferable. After some experiments I decided on using this, in the proportion of one part of the acid, known as Beaufoy's No. 11, to five of water. This I injected daily into the carious cavity, and applied also by introducing lint dipped in the solution, being careful, however, not to plug the opening. I venture to commend this practice to others. Gouging may appear to hasten these cases, but for the reasons I have assigned I do not believe such is really the case.

Whilst on this subject I may refer to a condition of cancellous texture, apparently the precursor of caries and abscess, where an opening into the bone affords immediate relief. When, for instance, the symptoms and sufferings of a patient may induce the surgeon to trephine the head of the tibia, in expectation of opening an abscess, he may find no pus: yet he need not regret his operation, for the suffering will probably be relieved, and the diseased action be cut short by the discharge accompanying the healing.

Plastic surgery.—The operations included under this head were comparatively few and rare when I was young. Stromeyer and Dieffenbach were the chief authorities on this subject at that time, and I have witnessed the clever operations of the latter when I was studying in Berlin. He was fond of Englishmen, and I accompanied him several times in his private practice as well as in his hospital. The conser-

vative character of plastic surgery makes it attractive, and I have naturally had my share of it since the time of which I speak. Of special operations I have not much to say, but I would make one or two remarks on the subject generally which experience has taught me, albeit they may be of little value. I think there is not infrequently a disposition to do too much at once, and failure is the consequence. Of course the chief point demanding attention is to secure the vitality of the skin which is removed from one part to another; and this is accomplished best by leaving a broad attachment to the surrounding texture until the new relations are in a satisfactory condition. Twisting a peduncle often interferes fatally with the circulation in the flap. The bond of new adhesion should be as broad as possible, and the sliding of a flap to its new position is the best mode of filling a gap where it is practicable. Edge-to-edge union often fails. I think fine needles produce less irritation than sutures, where they can be used, and tension should be obviated by every available means.

The operation for ruptured perineum illustrates these principles; the sutures must be deep and the surface of adhesion broad for success to be obtained: and I was guided by failure from previous neglect of this desideratum, in planning a successful attempt to close a large urethral fistula in front of the scrotum, by raising a flap from either side of the penis and uniting their *surfaces* over the gap, which was nearly an inch long. This case is recorded in the twenty-eighth volume of the 'Medico-Chirurgical Transactions.'

I may here notice an operation for enlarging the oral aperture—it could not be called a mouth—which was contracted by the healing of a burn. I used a fine pair of scissors to divide horizontally the skin and subjacent textures on either side, to the exclusion of the mucous membrane. A slip of the divided textures being dissected out, the mucous membrane was also cut parallel to the first incision, and the margin was fixed to the skin above and below. Regarding this, and indeed all plastic operations, I would remark that much margin must be allowed for subsequent contraction. I cannot say that in healing this operation behaved so well as I had anticipated. Less was obtained by this eversion and

fixing of the mucous membranes than, theoretically, I expected; and I may say the same in saving and everting the mucous membrane of the urethra after amputation of the penis. Contraction will take place, for the mucous membrane will not remain just where it is wanted, and, moreover, soon loses its characteristic texture.

Of saving or sacrificing an injured limb.—There are few opportunities in surgical practice where the exercise of judgment, discretion and prompt decision are more required than in determining the question whether a recently injured limb should be saved or sacrificed. The responsibility of the verdict is an anxious one, yet hesitation may be fatal. In some instances the refusal of the patient to submit to mutilation settles the question, but generally it is a responsibility which rests, as it ought, solely with the surgeon. Of course, I speak of those cases only which, from the nature and extent of the injury, admit of doubt; and in these surgeons do not always agree. The first consideration is to save life, *i.e.* not to risk it unduly to save a limb. Associated with this consideration is the supplemental one of how far the limb, if preserved, may prove useful or be a simple encumbrance to its owner. Precedents are valuable under these circumstances, but they may be misleading; for the local condition is not always the most important consideration, nay, in many it is quite secondary; and herein is the special opportunity for the surgeon to exercise his judgment. The general conditions alluded to may be classed under two heads, *viz.* that which exists as the immediate consequence of the injury, and that which has reference to the age, general health, antecedents, and temperament of the patient: upon the latter category only do I wish to make one or two remarks; and these observations are not less applicable to country than to town practice; though it is well known that in the pure air and healthier habits of agricultural districts the surgeon has valuable adjuncts in the treatment of his cases. Many old men retain their recuperative power, and young men are prematurely old, by reason of inherited tendencies or their habits. I should not, therefore, be very much swayed by age alone. But general health and susceptibilities demand consideration, as assisting in determining the question of which I

am speaking. A careful inquiry, therefore, regarding a patient's antecedents in these respects is essential, especially in reference to his habits. The abstemious man, of previous good health, would have a fair chance of recovery from an injury which would be fatal to a *bon vivant* or habitual toper, for whom amputation would offer a better prospect than the tedious healing of a complicated injury. There is one other element to which I have learned to attach considerable value, sufficient, indeed, in not a few instances, to weigh down the otherwise evenly balanced scale; I mean the moral and physical temperament of the patient. I speak now especially in reference to temper and disposition. This information can be obtained satisfactorily only from relations or friends, yet the watchful surgeon may learn much from his own observation. A placid, docile and patient disposition is as much in favour of a sufferer, as an irritable, nervous and impatient temper is adverse to his recovery; especially where long confinement and protracted and absolute repose are necessary conditions in the treatment. Other things being equal the placid man will recover where the irritable man will succumb.

As regards local conditions bearing upon this question, I would remark that very complicated injuries about the ankle-joint generally do well; whereas, apparently less serious injury to the knee-joint is relatively often fatal, if the limb be saved. Extensive laceration with loss of texture of the skin is a very serious injury, even though deeper textures be not involved: indeed, much laceration, without loss of texture, is often attended by severe constitutional disturbance, and therefore should not be regarded lightly. The risk of partial loss of vitality, dependent on the contused nature of a wound, requires consideration; and, of course, the quantity of blood lost and the risk of recurring hæmorrhage. But in truth every case must be separately studied. General principles based on experience and thoughtful reflection are necessary; but the surgeon who trusts to precedents alone to guide him in his practice will be constantly at a loss, not only in an emergency such as I have been considering, but in his every-day duties, which demand all the resources of a ready and cultivated intelligence.

Fissure of anus.—I remember the mother of a large family, who was suffering from fissure, once saying to me that she would rather bear the pain of giving birth to a child than that incurred by the act of defecation when the bowels were confined. There is no doubt the suffering is great; and it is aggravated under distension by the rigid contraction of the sphincter consequent on its morbidly excited reflex action. Happily the remedy is simple and sure. It is a singular circumstance that the fissure is so usually in the coccygeal border of the outlet. Why this is so I do not know, except it be that there is less redundance of cutaneous texture here; certainly its presence at any other part is quite exceptional. In operating it is not necessary to cut into the fissure, though it is desirable to cut near it. I have never forcibly dilated the sphincter so as to split the fissure, for I do not recognise any advantage in this coarse mode of operating. The forefinger of the left hand having been first introduced into the bowel, a straight and very narrow bistoury with a button-point is introduced along the palmar surface of the finger; its edge being then turned towards the bowel, the cutting is done in withdrawing it. The incision need not be very deep, but should be carried with tolerable freedom outwards, so as to divide the skin of the verge and the inner fibres of the cutaneous sphincter. A shred of lint may be laid in the wound for twenty-four hours, but it is scarcely necessary. These fissures are often quite out of sight, but can generally be felt; the contraction of the sphincter hides them. It is foolish to temporise with this condition; caustics torture without curing. I have known suffering like that caused by fissure as the consequence of a thread-like band crossing the back edge of the anus, but this would be readily detected if it existed. I have never had to operate a second time.

Ligature of arteries.—I have very little to say on this subject, although I have tied repeatedly almost every artery in the body except the iliac. This exception is remarkable, as I had a full share of operations during nearly the whole of the thirty years that I was actively engaged at the hospital; yet it is not more so than a similar circumstance noticed in my remarks on injuries of the head. I have twice tied the common carotid for penetrating wounds of the neck, when the

source of hæmorrhage could not be identified, and there was no time to be lost. Both cases recovered without any cerebral symptoms whatever. In similar circumstances I should be induced to adopt the same operation: to search for a wounded vessel, in either of these cases, would probably have been futile and almost certainly fatal.

I once tied the facial as it passes over the ramus of the jaw for a small aneurism of this artery higher up, which was thus cured. The first time I tied the subclavian artery for axillary aneurism the patient made a satisfactory recovery. But my second case was unfortunate; for at the end of a fortnight, when the wound was very nearly healed, and I expected that the ligature was about to separate, the patient, who was a man of passionate temper, raised his arm in a threatening attitude to strike another patient in the ward, and forcibly tore away the ligature. A few drops of arterial blood followed, but this gradually increased in quantity, and he sank exhausted. If an animal ligature had been used, and cut off close, in all probability this man's life would have been saved.

To the dissector nothing seems easier than to tie the brachial artery, but the actual operation is by no means so simple, on account of the surroundings of the vessel. In bleeding palmar arteries, where a compress does not command the hæmorrhage, it is usually preferable to tie the brachial at once: ligature of both radial and ulnar vessels is inefficient where the hæmorrhage is persistent, for the interosseal supplies blood in their stead.

In ligature of the femoral artery I prefer cutting over the sartorius rather than on its inner side; there is thus less risk of injuring the saphena vein, and the artery is more directly under the incision when the muscle is drawn aside. Moreover, by cutting too much to the inner side the edge of the sartorius might be missed, and the adductor longus be mistaken for it: but this could not happen to a competent anatomist, though I have repeatedly seen it happen, in the dead body, to those who ought to know better.

Ligature of the posterior tibial artery is not so difficult an operation as is often represented; it is only rendered so by ignorance of the relative anatomy of the parts concerned. The same may be said, in a minor degree, of the anterior

tibial high up: the adhesion of the muscles to the fascia is apt to confuse their relation to each other in the operation, and may thus mislead the surgeon.

I was present when Mr. South ligatured the aorta, assisting him throughout the operation. I did not approve of the main trunk being tied, because I felt that the common iliac was healthy enough to carry a ligature; but my opinion was overruled by my seniors. I remember dissecting a subject with complete obliteration of the thoracic aorta high up: but this process had been the work of time, and dilatation of the anastomosing vessels had kept pace with the diminishing calibre of the trunk. Can the sudden obliteration of the aorta in any part of its course be long survived? It is straining nature's resources too far.

My experience of secondary hæmorrhage after ligature of an artery in its continuity is that it occurs rarely in a healthy vessel, but is much to be dreaded in one of degenerate tissue. I cannot recall a single instance in which I have had occasion to tie a vessel of any size a second time from this cause; the subclavian case to which I have referred was exceptional, and did not admit of a second operation.

Ruptured bladder.—Ruptured bladder is generally regarded as a fatal injury; and so, indeed, I believe it is, with rare exceptions. Yet the judicious boldness which has, of late years, had one of its manifestations in more free exploration of the abdomen, seems to offer a possible, if not a probable, remedy for a condition which admits of no other satisfactory treatment. I say that there are rare exceptions to the fatality of these injuries; for I believe that if the rupture be in a favorable position for continuous drainage, with a long tube attached to an elastic catheter, a rent may be spontaneously closed: and I relate the history of one such case in my published lectures delivered before the Royal College of Surgeons (p. 333). But, unfortunately, we have no means of judging of the position and extent of the rent, though the symptoms and signs are generally of a nature that leaves no doubt as to the character of the lesion. I have remarked, however, that which, *à priori*, would probably not be expected, that the presence of urine in the peritoneum is not resented so actively as that of intestinal contents when extravasated

from ruptured bowel. The shock consequent on rupture of the bladder is, no doubt, considerable ; but so far as the immediately consequent peritonitis is concerned, I should not expect death to result from this cause, if the mischief could be arrested by surgical interference. This has surprised me, as the presence of urine in areolar tissue is so certainly and speedily destructive wherever it spreads : but possibly the peritoneal secretion may vary more than we are aware of in the constituents it holds in solution ; and thus the urine, especially when freely diluted, may not be so entirely foreign when present in the serous cavity as it is when diffused in cellular tissue. I should not hesitate, with my present opinion on the subject, to open the abdomen to search for the rent, and to close it if possible—and it generally is practicable—and subsequently to secure efficient drainage in the way I have noticed. In performing such an operation I should be careful to sponge out the pelvic cavity, and I would close the wound in the bladder with animal sutures cut off close. I cannot support this opinion by any personal experience of its result ; I can only recommend it as justifiable from my knowledge of the usual fatality of these cases, and from belief that this fatality is due to the perpetuation of the mischief rather than to the immediate effect of the lesion. But I will not pursue this subject further, as I have discussed it more fully in my college lectures.

Primary and secondary amputation.—I will make but one or two remarks on this important subject, which has justly received so much attention from many able commentators. Where amputation is imperatively demanded, *i.e.* where there is no question of saving a limb, it is only profound collapse that would induce me to delay an operation. I say profound collapse, because shock, more or less severe, is a necessary consequence of these injuries ; and their complicated nature, moreover, generally involves the risk of recurrent hæmorrhage when reaction comes on. There are no circumstances under which I dread to encounter nature—if I may so express myself—so much as in striking a blow when she is making an effort to rally after a shock ; for when she feels it she is apt to surrender in despair. It is more judicious to strike again before there has been time to rally ; for it is remarkable

how little the second shock is felt at this time ; and, if hæmorrhage can be controlled, it adds little to the peril of the patient's condition. But these remarks do not touch the question of primary or secondary amputation, in their strict meaning ; for the definition of the latter, as regards time, should be limited to that condition which supervenes after some effort at repair has been made ; when, from whatever cause, it appears that the effort is failing, and that the life of the patient will probably be the penalty. Where amputation, sooner or later, is evidently the only remedy, I have no hesitation in preferring an early operation, and especially for the reasons I have just assigned in speaking of immediate amputation. But when the nature and extent of the injury, and the general condition and antecedents of the subject of it are such as to leave on my mind a reasonable doubt of the incurability of the lesion, I should be disposed to give the patient the benefit of that doubt : and this for the following reasons. The circumstances of the case would probably admit of the reparative power of the patient being tested until a sufficiently advanced stage of the case had arrived for the infliction of a second shock to be borne with comparative impunity ; and the surgeon may then interpose beneficially, by relieving what I may term an avowedly fruitless effort : and I may observe that this is a condition in which Nature—to continue this figurative mode of expression—welcomes such interposition, and thankfully transfers her previously futile agency to the kindly healing of the fresh wound. Moreover, it is to be borne in mind that, with this prospect in view, we give the patient a twofold chance ; that of saving both life and limb ; and, at worst, a reasonable hope of saving his life, by the sacrifice of his limb if that should become necessary. And it must be familiar to all surgeons that, in amputation under the circumstances referred to, the expectation of recovery is much better than in primary amputation ; for I should place such cases as I am considering, in the same category with similar operations necessitated by wearing disease ; which are, in the absence of organic or other impending mischief, far more successful than primary operations of importance needed for injury. Amputation of the thigh, for instance, undertaken for hopeless disease of the knee, generally succeeds, and recovery is often

rapid: whereas the same operation for a crushed joint is too often fatal: such, as least, is my experience. And I am disposed to view many other operations in the same light. I have observed that where patients have suffered severely from stone in the bladder, provided that suffering is not due to organic mischief, they recover more satisfactorily after lithotomy than those who have suffered little, because the relief experienced is greater: and so with other operations. Indeed, each year's experience has added to my confidence in Nature's resources and my vigilant observation of her indications: and this, after all, constitutes, in my humble opinion, the great lesson of a long life spent in the observation of disease; and it should find its practical application in a watchful respect for all she is willing to disclose, and a compliant—I do not say servile—submission to her guidance. But this study must carry with it a capacity for the just interpretation of what we witness; which, also, experience alone can impart.

Amputation at the shoulder-joint is rarely demanded for injury: if only the tubercles and their attached muscles be left, it is wonderful how useful even this short but mobile stump becomes. I have only twice amputated at the hip-joint for disease, and both patients recovered from the operation.

Of the nature of the flap in amputations.—Most surgeons have their special opinions on this subject, some preferring much and others but little or no muscle in the flaps of their amputations. After testing various methods I have, for a long time past, arrived at the conclusion that the skin-flap, in most cases, makes the more satisfactory stump, when fully healed. The only exceptions to this rule are those in which the entire limb is removed at the shoulder or hip-joints. In primary amputations for injury we must of course be guided by circumstances: yet these are rarely such as to necessitate a deviation from the rule. It is true that flaps, with plenty of muscle and nicely adjusted, make a far more sightly stump at first: but it is rather of the stump healed than of the stump after its first dressing that we ought to think; and, as I have said, I have found the exclusion of muscle more generally successful in this respect. Reactionary hæmorrhage is less likely

to occur when the muscular arteries are cut through transversely than obliquely. The tension of the adjusted flaps is less where skin, of which there should be an ample sufficiency, is alone employed : and I think the risk of much suppuration is thereby limited. Moreover, it is somewhat difficult to forecast how the muscles, if composing part of the flap, will behave, as regards retraction. Certainly, in immediate operations for injury, if muscle be retained it must be cut shorter than where the operation is for the removal of disease. This seems paradoxical, but the explanation is simple. When touched by the knife the healthy muscle contracts vigorously ; and if divided in this contracted state, its subsequently relaxed condition will manifest the correctness of the remark, by the inconvenient redundancy of the flesh protuding even beyond the skin, especially in such long unattached muscles as the ham-string. Such is not the case in the attenuated muscles of a diseased limb, in which the retractile property of the skin is relatively less interfered with. Insufficient skin, in either form of operation, is a serious defect ; but even a superfluity is no great fault, though certainly undesirable. I prefer two semilunar flaps (except in the upper arm) to the circular incision which was almost universally employed when I first entered the profession. The former method admits of more easy adjustment ; and if there be suppuration the drainage is better. The most accurate adaptation should be secured with plenty of sutures ; but not until sanguineous oozing has ceased. All fibrous structures, such as tendons and fascia, should be removed as far as can be from the flaps.

One word respecting Pirogoff's amputation. My experience of it is not encouraging : it is too uncertain to trust. When successful in the union between the opposed surfaces of the tibia and os calcis there is nothing to be said against it : but I would rather trust to Syme's amputation of the foot which rarely fails of being a complete success.

Fractures of the skull.—I have treated of this subject in my College Lectures, especially in the relation of fractures to lesion of the great nerve centre, and have also made some remarks on the mechanical causes of fracture of the base of the skull, which I do not wish to repeat here. It seems to me that the operation of trephining is of more frequent occurrence,

—finds more favour now than formerly. Whether this be so or not, it is a singular circumstance that I have never had occasion to perform this operation, pure and simple, in the whole course of my practice; and I have never had occasion to regret that I abstained from so doing. Of the value—I may say the inevitable necessity—of trephining in some cases I have no doubt: but it so happens that no such necessity has been laid upon me, though the operation was, in one case under my care, performed with somewhat needless haste, before I could reach the hospital; the condition being that of pressure from the presence of pus beneath necrosed bone, where no doubt the interference was appropriate. The fatality of the operation, *per se*, in the many cases I have witnessed has strongly impressed me with its serious nature; this fatality arising from sloughing of the dura mater and consequent extrusion of brain. The use of the trephine, but more commonly of Hey's saw, in removing depressed fragments of bone is of course familiar to me. In well-marked cases of suppuration consequent on fracture without depression, the application of the trephine is indicated; indeed it is essential: yet the result, so far as I have observed, is scarcely commensurate with the anticipation. In comminuted fracture there should be a careful search for fragments driven into the brain: overlooking any such fragments is, I think, more mischievous than any amount of cautious search; for it is remarkable how much handling, and even mutilation, the brain will bear without serious consequence: whereas, the presence of a foreign body in its structure is likely to cause fatal extension of inflammation.

That fracture of the base of the skull is a recoverable injury I have no doubt. I have witnessed some cases in which the signs and symptoms of this injury were too well marked to be mistaken, and where a slow recovery followed. One skull, which was long in my possession, and is now in our hospital museum, shows the line of united fracture extending across the base of the skull. It is very unwise to lose sight of a case, where the existence of any description of fracture has been suspected, until a long interval after convalescence has elapsed: for such cases often develop insidiously some secondary mischief; especially where the patient may

have resumed previous habits of work : and more particularly ought abstemiousness in living to be strictly enjoined for a lengthened period. The possible supervention of delirium should be anticipated in all head injuries ; and its consequences, due to the violence of the patient, should be carefully guarded against.

I have seen several instances of indented skull in young children, followed by early recovery ; the skull resuming its normal form in two or three days. But these cases are not rare ; though somewhat alarming to the uninitiated.

Operations in general and their management.—The performance of operations and their after-management constitute an important section of the surgeon's work. In our hospital practice, so much is done for us in all the previous and accompanying arrangements for a capital operation, that we are in a measure spoiled for private practice in these respects. In the latter, the surgeon is thrown more exclusively on his own resources. But in either case he should make his own arrangements, assign to each assistant his special duty, see himself that every requisite preparation is made, every suitable instrument or appliance is at hand, so that he may want nothing, but be prepared for every emergency. Moreover, it behoves him as far as possible, by careful forethinking over an operation, to anticipate every contingency, so that any such may not come as a surprise, when delay might be fatal. I have always thought it a very wholesome practice to resolve every complex operation into its different stages, and to deal with each separately, without allowing the mind to be distracted by those which are to follow. No doubt some steps in every operation of importance are more critical than others ; but it should be remembered that every step has its own special importance and bearing on the final one, and therefore should be executed in the best way. The speed of an operation is surely of secondary consequence, and should never degenerate into hurry, the ultimate success of the operation and the safety of the patient being the far graver consideration. I am satisfied that the most rapidly executed operations are by no means the most successful. On the contrary, I could cite many instances in which the reverse of this has been the case ; and also where great success has vindicated

this opinion, in the hands of operators whose characteristic was deliberation even to a fault. "Sat cito si sat bene," and "Respice finem," should be the mottos of any surgeon who may be tempted to exhibit his skill by the rapidity of his handiwork.

When the requirements for arresting hæmorrhage, whether by ligature or torsion, have been attended to, has the time for closing a wound arrived? Scarcely yet, in my opinion. If a cut surface be carefully watched, the sanguineous oozing from numberless points will be seen to be gradually replaced by admixture of serum with the blood, until the former predominates. This is the natural step towards the sealing of the vessels by the deposit of a plastic film over the surface of the wound. And here, I think, the surgeon may afford valuable assistance in facilitating this process. For many years I have been in the habit of using, for this purpose, a mixture of equal parts of spirits of wine and water, with which I have freely sponged the surface: after this the wound may be carefully closed with sufficient sutures of silk, or still better of silver, to secure the accurate and perfect adaptation of its edges: and then I have felt it safe to leave the wound exposed, for its entire margin to be sealed, if I may so express it, by the plastic deposit hardening in the intervals between the sutures. I cannot but speak favourably of this mode of treatment, because I have experienced its value; though I am aware it will find favour with but few nowadays. At any rate, it is consistent with the most absolute cleanliness. If reaction brought with it an excess of local heat, I used to place over the wound a rag with evaporating lotion. Thus much for healing by adhesion of opposed surfaces or edges. Where a gap has to be filled by granulation the requirements seem to be, as in germination, warmth and moisture: with these should be combined means for the absorption of the discharge, with security for scrupulous cleanliness by frequent change of dressing. Nothing so satisfactorily fulfils all these desiderata as simple water dressing. Either soft lint or cotton wool may be employed for this purpose; and warm irrigation of the surface is both soothing and cleansing.

A few words on the general condition of a patient after operation will conclude these remarks. The reaction after

shock *generally* bears a certain relation to the amount and duration of the latter. It is delayed where the shock is great and prolonged, anæsthetics notwithstanding: and such is naturally the case where the loss of blood had been considerable. And not only is this reaction, as manifested both locally and generally, to be looked for, but, if not excessive, it is to be welcomed as a measure of nature's activity in commencing the work of repair. On the morning after a serious operation I should always regard with anxiety the announcement that my patient had no complaint to make, and the absence of the usual indications of general febrile disturbance. I would far rather find him with a quickened pulse, a raised temperature and heightened colour, signs of nature's resentment at the injury inflicted, and of her energetic resolve to repair the mischief. As I have remarked, I am speaking only generally: there are exceptional cases in which reaction is but slightly marked; and others in which its excess is alarming. In each class the surgeon's resources are put to the test; and I know of few better opportunities of evincing judicious discrimination than in the management of such cases. In fact, the result of a capital operation very often hangs on the watchful and discreet supervision of the first few days, especially in regard to diet and stimulants. A primary consideration is to keep the stomach in good humour, and this is best secured by taxing its services as little as need be, and by soothing any irritability it may manifest. If the kitchen be kept in order, it is much more easy to regulate the rest of the house.

Stimulants, unless absolutely needed by the condition of the patient, or from long-continued habit, are prejudicial: but if required, for the latter reason especially, the taste of the patient should be consulted, even as to the class of spirit or wine or beer to which he has been accustomed. I have often proved the value of attention to such a trifling detail in the case of habitual tipplers: the stomach will tolerate gin where brandy nauseates, porter where ale disagrees; and the converse.

Moderation in diet should be the rule long after the early stage of repair is established: over-feeding springs from a mischievous popular fallacy, which is often, to the surgeon's

vexation, the explanation of serious relapses. It is needless to add that the action of the bowels should be carefully regulated.

Exploratory operations, &c.—An exploratory operation often clears up a doubt as to the nature of a disease. This may be accomplished with a grooved needle or small trochar: but I prefer a common lancet ground down to a fourth of its original breadth; just sufficient in fact to admit the introduction of a probe afterwards, if necessary. But not infrequently a free incision is required. For instance, it is not always possible to determine the nature of a mammary tumour: the resemblance in history as well as physical signs, between scirrhus and chronic abscess may render the diagnosis extremely obscure. This once occurred to myself, in a hospital patient, from whom I removed the breast, under the conviction that I was dealing with cancer: and others were deceived as well as myself. In this case no harm was done: for the induration surrounding the purulent cavity occupied part of the shrunken gland in an elderly woman; and she recovered more speedily than would have been the case under any other treatment. I have known similar obscurity to exist in other cases. Under these circumstances the best course is to make the first incision for removal of the breast, and to examine the tumour before proceeding further. The same remark applies to disease of joints: an exploratory incision may, where doubt exists, be made the first step towards resection or amputation, as the case may be. In removal of the breast the incisions are usually made with their concavities facing each other: I have found it preferable to make the upper incision with a convex edge directed towards the concave edge of the lower: the adaptation of the flaps, without puckering of the corners, is thus rendered more satisfactory. In large tumours, such as the fatty class, a single incision is generally all that is needed; skin should rarely be removed; for it is surprising how much the stretched integument gradually resumes its normal expansion, by its elastic contractility. This remark does not apply to the breast, where the excision of the gland requires a corresponding removal of skin.

Excision of joints.—This is a comparatively modern triumph of conservative surgery. Certainly very many limbs are now

saved which would have been sacrificed when I began my hospital work : sacrificed often not so much from a conviction of the absolutely irremediable amount of disease, as on account of the utter inability of the patient to endure the strain and exhaustion accompanying the reparative effort. It would be a bold assertion to affirm that no such casualty has happened as the occasional excision of a joint, which might have been saved under the old system of absolute and persevering rest. Although I have operated in many instances, and especially in resection of the knee-joint, I have but one general remark to make ; and that is, how very much importance I attach to the most scrupulous removal of every trace of diseased tissue. Too much time and care cannot be expended on this very material element of success. In speaking of this particular joint I may observe, that I have found the difficulty of keeping the osseous surfaces in exact relation is diminished by sawing through the condyles of the femur, in such a manner that the face of the section shall be convex, or rather present a very obtuse angle in the centre, fitting into a corresponding concave section or re-entrant angle of the tibia. This may generally be accomplished, and sometimes with advantage as regards the tibia, disease in which more often extends deeply than in the femur.

Imperforate and artificial anus ; exploration of rectum.—Most of the cases of imperforate anus that I have met with were only skin-deep, and required a simple incision for their relief. But this is not always the case, for the rectum sometimes terminates in a cul-de-sac, generally expanded, at some distance from the surface. One particular case of this kind, on which I operated many years since, I had the opportunity of watching throughout its long course. After searching deeply but in vain for the bowel, I obtained the father's sanction to risk the immediate death of the infant ; and by passing my knife upwards and to the left side I reached the bowel. I had the utmost difficulty in keeping the external opening from healing, by dilating it continually, and keeping a bougie in the artificial channel. The actual condition was this, as ascertained by repeated after-examination. The bowel terminated in a large sacculated extremity, in communication with which was the passage which I had formed, opening externally : this was, when the child grew older, about one and

a half or two inches long. When this channel was permanently established a new difficulty presented itself, which called for my oft-repeated interference, until the boy grew to be old and intelligent enough to take care of himself. For, in spite of aperients and parental supervision, the cul-de-sac became periodically loaded with indurated fæces, which I had to break up and get away with a scoop and by repeated injection of warm water. My patient is now himself a parent.

I learned a good deal from this particular case, and especially in exploring the rectum in obstinate constipation. This should never be neglected, and more particularly should it be insisted on, in the absence of symptoms indicating internal strangulation or malignant disease. In the female the examination may be assisted through the vagina. The worst case of obstruction of this kind that I have met with occurred in a young man whom I was requested to see in consultation. There had been no evacuation for six weeks, and his abdomen was as large and tense as that of a woman about to be delivered. Aperients and injections of various kinds had been used in vain. On passing my finger into the bowel, I could just touch with its extremity a large mass of fæces. Conjecturing that this was the cause of obstruction, I introduced the handle of a tablespoon along my finger and began the process of disintegration, repeatedly washing out, with an enema syringe, the detached fragments. It was a long and tedious process, but ultimately quite successful. As soon as this mass was broken up and removed the bowel was unsealed, and I should be afraid to form an estimate of the surprising quantity of solid and fluid matter that was discharged; for the injections had been retained, and were added to the natural contents of the intestine. The patient's condition was such that he could not much longer have survived without relief: and I am satisfied that nothing but mechanical disintegration of this large and indurated mass could have relieved him. I need not add that he made a quick recovery.

This blocked condition of the rectum I have occasionally met with in young children, just after weaning, and apparently due to the substitution of food containing a good deal of solid matter, for the previous fluid diet. The distressing straining

of the infant will suggest this explanation, and the hardened mass must be broken up as described.

An artificial communication with the bowel is sometimes established spontaneously or accidentally. In one instance the only interpretation I could put on the history of the case was, that a crural hernia had, when strangulated, been permitted to take its natural course; and this was an unusual one, viz. by sloughing of the intestine and subsequent abscess, opening externally. Of course this is very exceptional, and could not occur except where a portion only of the cylinder of the bowel was implicated. By persevering care this opening was ultimately closed. A similar condition occurred in a case of my own, where the adherent bowel gave way after operation. In this patient also I was fortunate in closing the sinuous track which led to the intestine, by the careful and long-continued employment of pressure. In a case of umbilical hernia, which had been opened, evidently under the conviction that it was an abscess, the patient died. The most remarkable case of this class that I have witnessed was also one which I attended in consultation. A large, indurated and inflamed swelling occupied the whole of one buttock and loin, and extended over the groin and left hypogastric region. At one point only, near the groin, was there fluctuation. An opening was made here, and the source of the mischief traced to the descending colon, from which fæcal matter escaped freely. It is needless to pursue the subsequent history of this case, which was in the hands of an able provincial surgeon. The patient rallied, and the artificial anus was established: but he ultimately died from some organic complication, when there seemed to be fair hope of recovery from this severe local mischief.

Dissecting wounds are, I believe, more rarely succeeded by serious consequences now than formerly, probably because of the antiseptic treatment of subjects for dissection. I can recall some fatal cases; and in the course of my long experience, as a teacher of anatomy, I have been a frequent sufferer myself, for I seemed to be peculiarly susceptible of the poison: so much so that I always kept materials for water dressing at home in my bedroom. The first sensation I experienced was that of tingling in some part of my hand, which

was often the earliest notice I had of any hurt, but which I knew was the precursor of mischief. I was always in the habit of incising a puncture as soon as I was aware of it, and of bleeding the part freely in hot water, before applying the water dressing. Sometimes I applied caustic, but I think this more often did harm than good. Scarlet threads traversing the arm, and enlarged axillary glands, with some constitutional disturbance, usually terminated my trouble: but I have had palmar abscess, and, on two or three occasions, a peculiar erratic erythema over the hand. This last condition I have witnessed in other instances, and it seems peculiar, in this form, to poisoned wounds. The most severe cases of these injuries I have met with were the most rapid: those in which the beneficent agency, whatever it may be, of the lymphatic glands is not interposed. The zymotic action of the poison, for such I suppose it must be, seems to be quick and unchecked, being favoured by a peculiar receptivity in some individuals, and often those who have the appearance of rude health: the constitutional symptoms are then severe, and death occurs early. In some instances I have known the poison to exhaust itself locally, by extensive sloughing of the arm, consequent on acute cellulitis. I have never experienced, personally, the ill effects of any specific poison, except that of a modified attack of smallpox, when an apprentice, from dissecting a subject which died of the disease. But then we were obliged to take whatever we could get from the only purveyors. Translation into a pure air, as soon as possible, is the most efficacious treatment of organic poisoning, whether from wounds or otherwise. A bold step in this direction is justifiable even in critical circumstances: I have known it to prove so in the result.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

(Continued from 'St. Thomas's Hospital Reports,' N.S., Vol. XII, p. 44.)

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In-growing nail.—Corns and warts.—Treatment of abscess.—Nævus.—Colotomy.—Carbuncle.—Erythema.—Gouty deposit on penis.—Stricture.—Pneumothorax and emphysema.—Pulse, temperature, tongue, &c.—Fractures of patella.—Hæmorrhoids: prolapse of rectum.—Contracted skin and fasciæ.—Influence of food and drink on health and longevity.—Fractures into or near joints.—Railway accidents.

In-growing nail.—This painful affection is often so troublesome to deal with that very rigorous treatment has been adopted for its cure. I think that in most cases this is unnecessary. Either side of the great toe-nail may press upon and cause ulceration of the neighbouring skin, though this is more frequent on the inner border. Except in very aggravated cases I have found pressure and glacial acetic acid accomplish all I required. The offending portion of the nail should be first pared or scraped to reduce its thickness; then a small pledget of cotton wool, wetted with the acid, is placed over the scraped nail adjoining the wound, and kept in contact with it by the application of a strip of plaster. It may be necessary to repeat this two or three times, taking away fragments of the thinned and softened nail and increasing the pressure each time. Finally, firm pressure must be made on

the hypertrophied skin, which will shrink rapidly under its use, and the foul ulcer will clean and heal. The patient must be taught how to manage himself after this, to prevent a recurrence of the mischief. I do not say that all cases will yield to this treatment, but certainly I have found it remarkably successful in many and even bad cases, and it has the advantage of being attended with comparatively little pain; indeed, the pressure, if applied at the right time, is a relief to the patient. I have usually employed a simple strip of adhesive plaster for this purpose; before renewal the foot should be soaked in warm water. The acetic acid acts by softening and thus gradually destroying the texture of the nail.

In the subsequent management of the nail it is a safeguard to notch its extremity by cutting out a V-shaped piece from the centre, the angular junction of the two sides of the notch being at a point as far removed from the free border as possible without injury to the quick or sensitive part. The foot should be previously soaked in warm water to soften the nail. This little operation will require repetition by the patient as often as the nail grows up, its effect being to relieve the lateral pressure of the nail. If it be an exostosis which drives the nail over to the opposite side, and thus initiates the mischief, of course no palliative treatment will be effective until the exostosis is removed.

For foetid ulceration round the base of the nails strong nitric acid is required.

Corns and warts.—Whilst referring to the action of glacial acetic acid, I may notice its usefulness in corns and common warts.

In treating *corns*, after some of the surrounding indurated skin has been rubbed down, a portion of the central conical projection should be picked out, and a small drop of the acid should be deposited in the hollow and allowed to remain till it disappears. If this process be repeated a few times, the acid being applied each time after the softened centre is removed, the corn will be eradicated. Where the tender part is less circumscribed, a file or piece of pumice-stone may be used for rubbing it down before the acid is applied. The part may be protected with a piece of cotton wool in the intervals, especially when the corn is between the toes.

A soft corn is only a common corn kept soft by the confinement of the perspiration. If the feet were bathed every night in warm water and well rubbed afterwards, especially between the toes, there would be less complaint of suffering from corns than there is. Of course tight boots and shoes must be eschewed. There is an absurd popular belief that frequent bathing of the feet in warm water is debilitating: this prejudice is, I suspect, begotten of idleness, as tight boots are the offspring of vanity.

Common warts yield, without pain, to the same remedy employed in a similar way. The wart should be rubbed down with a file or a piece of pumice stone, and then a drop of the glacial acid is to be applied and allowed to soak into the warty texture. This operation should be repeated daily, or at longer intervals, until the morbid growth is eradicated. If the part can be kept covered during the treatment so much the better. Nitrate of silver is of very little use in these cases. Strong nitric acid will no doubt destroy a wart speedily, but a troublesome sore is not infrequently left by it, and its use is after a time attended by pain. The acetic acid is painless and sure, though it requires time and perseverance to destroy large warts.

Treatment of abscess.—The management of abscesses seems an elementary matter to the uninitiated, but really involves many important considerations, and requires both tact and experience. The time for opening an acute abscess must, of course, depend on many circumstances associated with locality, texture, size, cause of its existence, and condition of the patient, as all competent surgeons know. The operation may, of course, in many instances be deferred until the abscess is *ripe*, *i.e.* until the skin, if it be near the surface, has been sufficiently approached to secure a ready drainage without adventitious aid. But I think it is not infrequently delayed too long, *i.e.* until the skin has become so much thinned by absorption as to threaten its vitality and to ensure an ugly scar. As a rule, I think it better to open a circumscribed abscess—especially under the circumstances just alluded to—at the margin rather than at the most prominent point; of course it should be at the most depending part. By this arrangement better drainage is secured, and the risk of getting

an ulcerated opening and consequent scar is materially less than when the incision is made through skin of low vitality. Where there is necessary movement of a part, as in the groin, a vertical is preferable to a horizontal incision, for thereby the constant opening and closing of the wound is avoided, and the healing is not protracted, as is so commonly the case when the incision is parallel to the fold of the groin.

Premature opening of abscess of the *tonsil* is fraught with mischief. Indeed, I think the cases in which interference is desirable are exceptional; for if the matter be deeply seated the opening almost always closes again, and the suffering of the patient is prolonged. When the knife is used its blade should be carefully guarded with a piece of lint wrapped round it at a short distance from the point, which should be directed inwards. When I leave these abscesses to burst, I generally direct the patient to have the head well supported, in fact, to sleep nearly in the sitting posture; for I remember one instance which occurred when I was very young, in which a patient died suddenly from the breaking of a tonsillic abscess, as I believe, from the rapid ingress of the pus into the trachea.

Various plans of managing large *chronic abscesses* have been recommended. Their removal by absorption of pus is a rare occurrence, therefore the question often arises as to the safest method of opening them. Inflammation of the wall of a large inactive abscess is serious, for it is attended by much constitutional disturbance. Yet this is a very common occurrence if air be admitted and the pus undergo decomposition. On the other hand, a free incision and constant drainage will induce hectic and exhaustion. I have found the safest course to be that of making a small opening, say of the breadth of a common lancet, at a depending point, to allow so much of the pus to escape as the natural elasticity of the parts will express, and then to apply a bandage of elastic webbing around the limb, or wherever it is practicable, covering the wound with a pledget of lint, but *not* introducing any between its lips. By a repetition of this operation at intervals the cavity of the abscess will gradually diminish, without overtaxing the power of the patient.

Of the use of drain-tubes I acknowledge I have but limited

experience. I was always averse from their employment, as I am satisfied they often do more mischief than good. No doubt they are valuable, indeed necessary, in some instances; but, except in dealing with long and tortuous channels, I would rather trust to nature than risk the consequences of the necessary resentment excited by the introduction of a foreign body.

Sinuses are proverbially troublesome to deal with. When running horizontally or near the surface, free incision is no doubt the most certain method of curing them, by converting the sinuous track into a simple sluggish ulcer: but such sinuses I have often cured by injection of a solution of caustic sufficiently strong to ensure plastic effusion. This should be followed by firm pressure so as to keep the walls of the sinus in contact; they will then adhere. Sometimes pressure alone will accomplish this object, for the chief obstacle to obliteration is the mechanical one of constant accumulation of discharge within the sinus, succeeded, no doubt, by the secretion of a fluid in which there is no reparative material.

Nævus.—For the destruction of a cutaneous nævus I have found the strong nitric acid the best application. This form of the disease is not always continuous in its extension; sometimes, in children, it becomes after a time self-obliterated.

I have often injected subcutaneous nævi; but there is danger in this mode of treatment, and I have for a long time discarded it in favour of another method which is equally efficacious and far more under command. It is this,—I use a broad, lance-shaped needle set in a handle, or a small tenotomy knife, with which I perforate the skin immediately external to the margin of the nævus, and cut up the diseased tissue within. Having previously prepared a probe by dipping its point in nitrate of silver melted in a watch-glass, I introduce the probe along the track made by the needle and move it freely about in the tumour until the caustic is dissolved. This plan has the further advantage of preventing bleeding by the track, and of securing an opening for discharge should suppuration ensue. A large nævus may require a repetition of the operation. I have never used galvanic or other cautery in either form of the disease. Excision is not often needed or admissible.

Small nævoid points, which are often a disfigurement to the face, are readily cured, without scar, by touching them with a point of heated metal. The proper instrument for this is a rod of steel, bent at the end and expanded into a small bulb with a point to it. This is heated in a spirit lamp, and can be accurately applied to the centre of small radiating vessels of which the disfiguring spot consists. No after-treatment is required, but the eschar should not be meddled with.

Colotomy.—I would bear my testimony to the value of this operation as a palliative in malignant obstruction of the bowel, by removing a very distressing source of suffering to the patient. I prefer an oblique to either a vertical or horizontal incision; and the exact line of the incision should be distinctly marked beforehand with an indelible fluid or pencil.

Carbuncle.—Whatever may be the pathological explanation of the origin of carbuncle, its local treatment is not influenced thereby. Premature interference with the knife is to be deprecated; it does more harm than good, and I have very little confidence in any measures which are advocated for "cutting short" the disease. It will run its course, or, if thwarted, develop itself in a neighbouring part. It is still, I believe, the common practice to incise a carbuncle freely; yet I have long since relinquished this mode of treatment with, I believe, satisfactory results. The temptation to relieve the tension of a large carbuncle is, I admit, great, and in some instances the position of the disease and the suffering of the patient may require it. But such cases are few. Early incision, I have said, is mischievous; and when the softening-down process has commenced, and pinhole openings of ulceration appear, the surgeon may help nature by passing the point of his bistoury deeply down into these apertures, so as to facilitate the escape of the softened plastic deposit and sloughs. Warmth and moisture, in the form of poultice and fomentation, should be assiduously applied, and may be rendered stimulating if desirable. A poultice of scraped carrot or of linseed-meal mixed with yeast is useful in this respect. I have found the reparative process more speedy in cases treated in this way than where the diseased mass has been freely cut across; and the destruction of skin, if not less, is of a character that admits of much speedier healing, because

no large gap is left, but every island which retains its vitality is a centre from which fresh skin is produced. Stimulants and tonics should not be indiscriminately administered in large quantities. Attention to the healthy condition of the secretions is an important part of the treatment.

Erythema.—There is much the same difference between erythema and erysipelas as between a common boil and a carbuncle; and the local treatment in each case varies accordingly. I have never found nitrate of silver of any use in erysipelas, but of much value in erythema. I think its reputation in the cure of the former disease must have arisen—in some instances at least—from the two complaints being confounded. Spreading erythema may be generally arrested by circumscribing the affected part with nitrate of silver, applied in the stick. I have several times suffered in former years, when I was teaching anatomy, from an erratic form of erythema following poisoned wounds of the hand, and have found the caustic useful on these and similar occasions. I suppose the effect produced on the cutaneous capillaries by the application renders them insusceptible of the spreading inflammatory action; the prairie fire is arrested by burning the grass in front of it.

Gouty deposit on penis.—I have seen four cases of this affection, which was, I believe, first described by Sir Prescott Hewett. One, the first, was a hospital patient, the others were private patients. One occurred in a young man of thirty, one in a man of forty or forty-five, and the other two were in elderly men. My hospital case much puzzled me, for I did not know what it was, and did not ascertain whether the patient was gouty. In the other cases the gouty diathesis was unequivocally marked. In all the deposit was chiefly on and apparently attached to the dorsal surface of the corpus cavernosum, but so far involved its texture as to give rise to the complaint that erection of the penis was accompanied by distortion. The impression conveyed to the touch was that of a large and firm scale of cartilage laid over part of the dorsal surface of the cavernous body. No pain was experienced, except when the organ was distorted. I did not watch my hospital patient long, as I could do nothing for him; but in the other cases, which I kept under observation for a lengthened period, a long time

elapsed before there was any change; ultimately, however, in two of them I had the opportunity of learning that the deposit had almost or entirely disappeared. These deposits did not seem to be affected by treatment.

Treatment of stricture.—Few subjects have attracted more attention among surgeons than the treatment of stricture; and the measures adopted for its relief or cure are many and various. Simple dilatation is the most natural and safe; and I may add that I think it the most lasting where it is successful. But it is tedious and, in some instances, inapplicable. When a more speedy method is demanded, which is the best? I prefer caustic to cutting or splitting. I am aware this practice is not held in good repute; but here I am speaking only of my own experience of its utility. It of course requires care in its employment, but in this respect it is not peculiar among remedies. I have used the potassa fusa in many cases, and have found it especially useful in firm and irritable strictures, and I cannot recall a single instance in which I have regretted the selection of this method of treatment because of any ill consequences resulting from its use. It is necessary, in the first place, to be satisfied that you can pass a good-sized sound down to the seat of stricture. The instrument I employed to apply the caustic was a sound of medium size, with about half an inch of its extremity perforated with a small aperture, and made to screw securely on to the shaft of the instrument. On the summit of the long male screw, and therefore near to the aperture, the caustic was placed in a small piece of lard. Its gradual deliquescence allowed of time to pass the instrument down to the stricture, against which it was to be firmly, but not forcibly, pressed for one or two minutes. Not infrequently the obstruction was at once overcome, and the sound was passed on into the bladder, or a second operation might be required after the lapse of two or three days, if a moderate-sized instrument could not be passed. Generally a small slough is washed out with the urine. The patient should be kept quiet on the day of operation.

It is scarcely necessary to add that an instrument of some sort should be passed afterwards from time to time; and with this precaution I do not hesitate to say that, in suitable

cases, this treatment is not only safe, but the relief is, in most instances, enduring.

Emphysema and pneumothorax.—I have seen the entire trunk, face, and a portion of the limbs distended by air extravasated into the subcutaneous areolar tissue, and I have seen one pleura distended with air, to the entire occlusion of the corresponding lung and the displacement of the heart. Yet I cannot recall an instance in which either condition with its causative injury, when uncomplicated with other mischief, has proved fatal.

It is well known that external emphysema is unimportant, except in so far as it is an indication of wounded lung. But I remember the anxiety occasioned by my earlier cases of pneumothorax as I watched the increasing dyspnœa and blueness of lip, prepared to give relief by tapping the pleura if needed. But I have never found it necessary; indeed, unless imperatively demanded, it is an ill-advised interference, inasmuch as it impedes or arrests the relief which nature is preparing.

The comparative infrequency of wounded lung in fracture of rib is evidently due to the mode in which the ribs are usually broken, *i.e.* by being over-bent by pressure on their extremities; the bone is then broken outwards, and the fractured ends do not encroach on the cavity of the chest. But when the violence is inflicted directly on the injured part the rib is driven inwards, and the lung is almost inevitably wounded. This is usually indicated by the condition I am considering; either emphysema or pneumothorax, accompanied generally by some spitting of blood sooner or later. This, together with the inflammation of the lung which follows, is usually localised; unless in specially predisposed patients, general pneumonia is a very rare sequence. If the inspired air finds a ready exit into the areolar tissue, the patient generally escapes pneumothorax, but when there is some obstacle to this extravasation, the air usually finds its way into the pleura. In some instances these conditions coexist, and if complicated by more or less pneumonia the physical diagnosis of the actual state of the lung becomes very difficult. This is owing to the way in which the lung sounds are masked, by the receding of the lung from the chest wall, and by the crackling

sound emitted by the external emphysema. In such cases we must depend very much upon the general symptoms, viz. the temperature, pulse, pain, and character of the expectoration.

But how is it that escape of air into the pleura is arrested? The fact is that this extravasation usually continues so long as air is drawn into the lung. As it recedes from the chest wall the facility for the escape of air is without interference, and the lung is never at rest. But as soon as it is emptied by compression and at rest, the healing process is commenced by the deposit of plastic material which closes the opening; and when the laceration is thus closed the lung gradually resumes its normal function. Therefore it is that interference, except imperatively demanded, is mischievous; and it is surprising how the system accommodates itself for a time to this partial privation of such an important function. It is scarcely necessary to say that the ordinary treatment of fractured rib must be delayed, or very cautiously exercised, until the lung begins again to expand.

What becomes of the extravasated air in these cases? It is said to be absorbed; but by what channels and in what condition or combination it is circulated, and ultimately appropriated or discharged, is conjectural: it is most probably by solution in the blood.

The pulse, temperature, and tongue.—The varying condition of these guides in diagnosis are scarcely less important to the surgeon than to the physician. Each may be deceptive and misleading, if trusted to alone, but this is rarely the case when they are studied conjointly. A quiet pulse is always reassuring, but a quick pulse, *per se*, need not be alarming. So many circumstances accelerate the heart's action that a hasty conclusion must not be drawn from this sign, and it is always better, for an obvious reason, to delay feeling a patient's pulse until the excitement of the doctor's visit has subsided. In young people the pulse is less reliable than in old; in children, especially, it is often very deceptive. The heart seems to respond so much more readily to any appeal in youth, however trifling. I am speaking now particularly in reference to surgical cases; but I remember Dr. Marshall Hall pointing this out to me when I was young. The strength of the pulse,

as tested by the resistance it offers to the pressure of the finger, is often more trustworthy than the frequency of its beat, though liable to misconstruction unless considered in relation to surrounding circumstances ; arterial constriction or capillary obstruction are not infrequent causes of deceptive strength of pulse.

The watery pulse which is obliterated under the mere weight of the finger, and the thready pulse are generally unmistakable evidence of feeble or sinking power. Yet, it is important in all serious cases to ascertain, if possible, the normal standard and character of the pulse, and also whether there be any abnormal arrangement of the arteries at the wrist, and to feel both sides, which do not always agree. The normal numerical standard of the pulse varies very much in exceptional cases, in some instances ranging very high, in others unusually low.

As variations in *temperature* signify corresponding variations in the evolution of animal heat, the combustion must be rapid where the temperature is high ; and this implies both quickened circulation and respiration. This may be localised where the area affected is limited, but when general it naturally excites uneasiness. But many instances occur in which a general rise of temperature is due to such transient cause as passing functional derangement. These temperature changes in disease are determined by the activity of the vaso-motor centres, of which the thermometer is the only satisfactory gauge ; and a pronounced and continuous deviation from the normal standard is a measure of the extent to which the nervous system generally, through the cyclo-ganglionic centres, is involved. Whatever lowers the temperature acts through the medium of the vaso-motor sources of nerve-energy.

Where the heart and lungs are healthy the *respiration* keeps pace with the pulse, unless, indeed, the air-passages be obstructed by spasm or from other cause, or there be some other palpable explanation of the irregularity ; I mean that a quickened pulse in disease is usually accompanied by corresponding quickening of the respiration. Yet this is not the case in health ; for the respiration is more uniform than the pulse. By itself, therefore, rapid breathing does not import much, the condition of the heart and lungs with the air-

passages, as a disturbing element in the diagnosis, being excluded.

The variations in the aspect of the *tongue* are worthy of careful study. It is difficult to describe satisfactorily these varied appearances; indeed, I know of no simple source of diagnosis which requires and repays personal observation more than the tongue; the association of its appearance with corresponding conditions of internal organs can be acquired by careful observation only. Yet the natural appearance of the tongue is not uniform; I mean that in health it presents a different appearance in different individuals; though this is only exceptional it should not be lost sight of. The tongue rarely deceives those who have familiarised themselves with the interpretation of its changing surface; yet in one respect it may mislead the surgeon who is, perhaps, anxiously watching the course of a serious accident or operation. Under these circumstances, some functional derangement to which the patient has been subject, or some localised inflammatory attack, such as limited pneumonia, may be first betrayed by a furred, or glazed, or dry tongue, and excite misplaced alarm. The lesson thus taught is a simple one, but not always applied; viz. that, in the absence of a satisfactory explanation of any diagnostic sign in relation to the condition for which the patient is under treatment, the investigation should be extended in other directions likely to offer a solution of the perplexity.

We are all more or less physiognomists, but the medical practitioner ought to make the *expression* of the face in disease his special study, for it is a valuable help in diagnosis. Even the position of a patient in bed will often show whether he is suffering and where. I remember a remark that was attributed to Sir Astley Cooper, that if he found his patient lying with his hands clasped behind his head, he was satisfied there could not be much amiss with him. But the expression of the eye is much to be depended on. The languor of depression is as far removed as the gleam of excitement from the peaceful expression of ease; and these differ equally from the vacant look of inanity, or the glare of delirium which reveals the subjective influence under which the intellect is wandering. It is difficult, moreover, for the malingerer to control the expression of the eye, however he may command his mouth;

a shrewd observer would detect the attempted fraud in most instances.

A soft *skin* of normal temperature may often correct an erroneous conclusion hastily founded on a quickened circulation, though a harsh and hot-feeling skin is not necessarily indicative of any serious functional disturbance. The readiness with which perspiration is excited varies remarkably in different individuals; a circumstance which should be borne in mind in estimating the value of this sign in diagnosis. The palm of the hand is generally the first area to denote this anxiously looked-for relief. It is difficult to account for the profuse perspiration which is met with in some cases, without assuming that it is an eliminative effort, although it may be abortive. Abnormal blood-pressure or loss of balance in the circulation is often redressed by the salutary abundance of this secretion.

Fractures of the patella have received a great deal of attention; and many expedients—some very inadmissible—have been resorted to for the purpose of securing accurate or osseous union. Why is the old-fashioned treatment by position discredited? I have seen excellent limbs, as useful in every respect as before the injury, after treatment by simple extension, and a couple of pads or straps to help to keep the fragments in position. But I have also seen very unsatisfactory results, yet not without explanation; and that explanation is usually, impatience on the part of the patient, and weakness of the medical attendant in yielding to the prayer for too early liberty. The mischief is not done during the ligamentous union, but in permitting it to be stretched and elongated by too early flexion of the limb. When there is fair ligamentous union, by all means let the patient get about; but the knee must not be flexed in walking until the union is sufficiently firm to resist the tendency to stretch, which is rarely under three or four months.

Is osseous union a desideratum? In other words can we secure, in such union, that perfect equality of articular surface at the line of fracture which is essential for free movement? My own experience does not enable me to answer this question; but it is worthy of consideration.

Hæmorrhoids, &c.—The most common cause of the varicosity

known as hæmorrhoids is venous obstruction from constipation. Pregnancy acts in the same way. I suppose the association between functional derangement of the liver and piles is due to portal congestion, and also to confined bowels consequent on deficiency of bile. That which is popularly known as an "attack of piles," and which consists in strangulation of a varicose mass by the sphincter, is best dealt with by puncture with a lancet, and subsequent application of ice or iced-water. I suppose no one would be inclined to select this crisis as suitable for a radical cure. I have tried all methods for the removal of hæmorrhoids, cutting, crushing, burning, and ligature, and am disposed to give a preference, in most cases, to the last-mentioned. If properly performed, I think it is the safest operation, and as little painful as any. The bowels having been freely relieved, the mass to be removed should be firmly held and drawn down with a suitable pair of forceps; the skin around the base of the swelling should then be divided by a circular incision, and the ligature firmly applied, so as to exclude the integument. If a double ligature be required, a needle may be used to carry it through the tumour, and it can then be tied on either side. In some instances small polypoid excrescences are met with in the interior of the rectum; these, if within reach, may be detached with the finger-nail; they are a source of considerable irritation and tenesmus.

Prolapse of the rectum is a very troublesome affection; in some cases occurring at every evacuation of the bowels to a limited extent. I have very little faith in any local applications for the relief of this condition, but the comfort of the sufferer will be consulted by recommending him to habituate the bowels to act in the evening, just before retiring to bed. This habit may be soon acquired; and rest in the recumbent posture afterwards for a lengthened period will assist materially in restoring a healthy tone to the bowel. Aloetic medicines are generally prohibited in these and similar affections; but I have found them valuable, for the simple reason that this drug relieves the rectum, and thus removes a common cause of the trouble. This remark applies especially to cases in which the sluggishness of the rectum is the cause of violent efforts to evacuate its contents. A pill, containing aloes (the watery

extract), with rhubarb and nux vomica, forms a good laxative taken at meal-time. The constant use of warm injections is, in my experience, prejudicial; their occasional use is serviceable.

Stricture of the rectum is not a common complaint, though often supposed to exist; and a vast deal of mischief is done by the heedless, sometimes unscrupulous use of bougies. Annular stricture of the bowel may be relieved, when within reach, by incision in three or four places, with a narrow and flat button-pointed bistoury; but in such cases the subsequent use of the bougie is essential.

Contraction of the skin and fasciæ.—There are few operations which are more disappointing to the young surgeon than those which he undertakes for the relief of contracted skin or fasciæ; at least such was my own early experience, and I have witnessed similar disappointment in the hands of others.

As regards the skin, it is almost as difficult to prevent contraction in the healing of a burn or breach of surface from any cause, as to cure it when it has occurred. All that can be done is to keep the injured parts on the stretch and to employ the modern method of skin grafting. Yet, with silent and steady step the contraction goes on, almost unimpeded by any mechanical obstacle. Moreover, it stops not when the breach is closed, but increases as the cicatrix thickens and becomes indurated. The power of this stealthy agency was well illustrated in a hospital case I had many years ago. I was very anxious to preserve freedom of movement in the arm of a boy who had been badly burnt about the axilla, and I contrived a piece of mechanism which rested, by a broad plate, on the ribs, and supported the arm in a narrow dish, the two being connected by an elongating screw arrangement. I had power enough here without, as I supposed, risking any mischievous consequences; but I was mistaken. Of the efficiency of the mechanism there was no doubt, but mischief resulted in a direction I had not anticipated, and was discovered not at all too soon. The boy's spine was yielding by lateral curvature, and I was compelled to relinquish my machinery. Simple division of these contracted scars is useless, and the insertion of transplanted skin as fruitless, unless the pseudo-skin be dissected out before inserting the new texture to take its

place. These were terrible operations, from their painful and protracted nature, before the boon of chloroform was introduced.

Very nearly the same remarks are applicable to contracted fasciæ. This condition is almost always the consequence of chronic inflammation, usually but not necessarily caused by mechanical irritation. These cases, which specially include contractions of the fingers and toes, are not difficult of diagnosis, and readily distinguishable from the much rarer form of contraction dependent on the tendons. Subcutaneous section of these contracted bands is easy, but the straightening of the finger or toe is not always the immediate result of the operation. Here the same difficulty presents itself as in the case of the skin. The fingers may be extended by various mechanical contrivances, though caution must be exercised lest pressure on the ungual phalanges produce mischief; I have seen impending loss of vitality from the incautious use of continuous extension in one of these cases. The most certain cure is excision of the contracted tissue where practicable; if left, sooner or later contraction will again ensue. I think contracted fingers were more common formerly than now; they occurred often in stage-coach drivers, and this race is now nearly extinct. In contraction of the toes I have found it sometimes the easiest and most efficient method of affording relief to remove part of the offending member. The suffering occasioned by the abnormal position of a toe thus affected renders the patient a willing party to the operation. I have never known the great toe to be thus contracted; the inner division of the plantar fascia is thin and feeble, and mechanically the position and free movements of this toe render it less liable to be so affected.

The influence of food and drink on health and longevity.—This is a well-worn subject; much has been written on it, and many are the experiments which have been undertaken to throw light upon it, yet it is a subject on which it is very difficult to generalise with practical advantage, except in educing from observation and experience some broad principles, which few would gainsay, and perhaps as few systematically adopt. With the lower animals the selection of food is limited by instinct and habit, and no doubt also by

the restricted sphere of the senses of taste and smell. But with man the case is different, the attributes of these senses, though less acute, are more expanded from inheritance and education, and the luxurious habits of civilisation supply plentiful opportunities of gratifying a natural taste for variety of food, which has been enhanced by cultivation. But it is this variety in the tastes and habits of individuals, combined with constitutional peculiarities, inherited tendencies, and special surroundings, which constitute the difficulty in attempting to impose an uniform standard upon all. Some of these peculiarities are very inexplicable, seeming almost capricious, whilst others admit of explanation. It is, for instance, intelligible why fresh rhubarb or tomatoes should disagree with a person prone to lithiasis; but it is not so apparent why the smallest quantity of honey or two or three damsons should produce distressing gastralgia, or hare cooked in any form should cause similar pain and sickness; yet I know instances in which these effects are invariably produced.

Milk is by no means universally acceptable to the adult stomach; indeed, I think it is exceptionally so if taken in any quantity; but, like other animal food, I have found it more digestible when cooked, or with the addition of a little lime-water. Much may be done by training the stomach to certain articles of food, and so valuable an article of diet as milk should not be thrown aside without this attempt. A frequent error is to make the trial with a large draught, and to condemn it if the stomach resent the liberty, whereas a gradually increased quantity may be taken with impunity and advantage.

Fish agrees with most people, but I have known some few instances where this is not the case. I believe the cooking of fish or the sauces with which it is eaten, are often unwholesome; plain boiling is the most wholesome form of cooking almost all fish. I have never heard a satisfactory explanation of the well-known fact that shellfish frequently produce sickness and nettle-rash.

I am disposed to regard roast or broiled meat more wholesome than boiled, as well as more nutritious. Young meat, I feel sure, is not so digestible as adult meat. Some persons can eat fat freely, others cannot digest it. As regards vegetables, I believe there is much truth in a remark of a former

physician of our hospital, that a variety in small quantity better suits the chemistry of digestion than all of one sort. I am not disposed to accord to the potato universal acceptance; I think there are some stomachs with which it essentially disagrees.

But these facts are familiar, and the lesson they teach is that no hard and fast rule can be adopted in diet; each individual ought to possess sense enough to discover what does not suit him, and self-denial enough to act accordingly; but the pleasanter and more general theory is that what is agreeable is wholesome. Certainly it is the doctor's business to study the peculiarities of each patient, whilst he lays down some general rules as to diet and abstinence.

One broad fact which my hospital experience has taught me is this: that a large proportion of the ailments of patients in the medical wards is due to their over-stimulation and malnutrition; and that the ill success of many of our operations and accidents in the surgical wards is attributable to the same cause. No doubt more mischief accrues from excess in drinking than from defective nutriment, but they often go hand in hand, and as cause and effect. Why should this heart give way before its time? Why that hard-worked kidney strike work at last? Why that liver lose its primitive structure and become useless? Each has done its own work and loyally helped the other, till the strain could be borne no longer. Alcohol must answer the inquiry. Why, again, does this simple wound entail phlegmonous inflammation of the whole limb? Or that operation fail from lack of rallying power in the patient? The same reply must be given. But it is not in hospital practice alone that we witness these things; more often, however, it is indulgence in food that is responsible for sickness and premature decay amongst those in easy circumstances. Indeed, it is my conviction that a large proportion of those who have the means indulge the appetite for solid food beyond the requirements of health. It is not variety that does the mischief, but quantity, the excess being stimulated by the variety.

I would here remark upon a fallacy which is so common among the young and robust when expostulated with on account of excess. They reply that it does them no harm,

they feel none the worse for it. Let them remember that nature, though kind to the reasonable, is an exacting creditor to those who betray her confidence and take advantage of her goodness; as years advance the penalty will be claimed, and probably with usury.

Is total abstinence from all alcoholic drink essential to meet these grave consequences? Surely it is to be preferred to any excess, but, except as an example to others, it is not needed; nor is it desirable for all. The simple lesson which a life of observation teaches is, moderation in all things and abstinence from that which is known by individual experience to be prejudicial; and this, apart from inherited tendencies and the accidents which necessarily beset us in our journey, is the patent secret of the healthy mind in the healthy body, and of the attainment of the allotted age of man on earth.

One word respecting the almost universal habit of smoking. The strong prejudice entertained by some people against this use of tobacco is not supported by facts impartially collected. There are two sources of fallacy in dealing with this subject; selected cases of excess are quoted, and cases in which, even in great moderation, smoking is injurious. I have no doubt that in some individuals this habit, if persevered in, would destroy health and curtail life; whereas in others it is not only an allowable indulgence, but is positively beneficial, by its anodyne influence on an excitable nervous temperament. In the aggregate, I believe, very little mischief is done by moderate smoking, and that it is injurious only to those who adopt it as a fashion, and pursue it notwithstanding unequivocal evidence of its disagreeing with them: but excess is in all cases to be condemned as injurious to health and also to intellectual activity. The noxious habit of inhaling tobacco smoke is to be unconditionally condemned.

Fractures near or into joints are often obscure and difficult to manage, and I know of no general rule by which the diagnosis between these injuries and dislocations may be determined with certainty. To the practised eye and hand the characteristic deformity is the best guide; the presence or absence of crepitus is often misleading. In short, each case requires to be judged of very much on its own merits.

In special cases there are special diagnostic signs, which are

described in surgical treatises, such as eversion, shortening, and mobility in fracture of the neck of the thigh-bone; but impaction or muscular rigidity may mask these signs. The mode in which an injury is produced, if accurately ascertained, rarely fails to indicate the probable nature of the resulting mischief, though I am far from saying that reliance is to be placed on this alone. In fact it is often impossible to learn with certainty how an accident happens; sometimes the soiling of some part of the dress will indicate where the blow was received; but the account of the patient must be accepted with caution. Fractures near to joints from indirect violence are, I believe, rare; whereas dislocations almost always are caused in this way. Thus, if you obtain unquestionable evidence of a patient having fallen with his arm extended, so as to receive the first impact of the violence on the elbow or palm of the hand, you may assume, almost certainly, that the loss of rotundity of the shoulder is due to the head of the humerus having been dragged out of its socket by the action of the latissimus dorsi and pectoralis muscles. If, again, you ascertain that a patient has fallen heavily on the trochanter major, you may infer that the deformity of the joint is due to fracture of the neck of the femur. I may remark, by the way, respecting the often-asserted fracture of this part of the bone as the consequence of a trip or false step, and, therefore, of indirect violence, that I believe this is almost invariably a fallacy, resting on the testimony of the patient only. The trip was probably caused by feebleness, but the fracture was produced by direct violence to the trochanter, in the fall.

Fractures near the knee and ankle are generally more readily diagnosed than those in close proximity to the elbow and wrist. But here again the nature of the causative violence is almost uniform as regards the elbow; fracture resulting from direct force, combined (in the prominences of the ulna) with muscular action, whilst dislocation is caused indirectly. At the wrist the diagnosis is simplified, *quoad* dislocation or fracture; for, though I am not prepared to deny the possibility of the radius being dislocated from the carpus, I have never seen nor met with a well-authenticated case. I apprehend that the insuperable resistance of the flexor tendons must explain the extreme rarity of this accident; whereas fracture of

the radius near to the carpus, as is well known, is a very common consequence of falling on the palm. I have seen a few curious instances of dislocation of a carpal bone, analogous to similar displacements in the foot. I have also seen dislocations of the tarsal end of the metatarsus; but I cannot recall an instance of simple dislocation of a metacarpal bone from the carpus.

The part which muscular action plays in the production of dislocation and fracture is a subject of interesting speculation and of some practical importance. I believe the muscles have very limited influence in the breaking of bones, except in the well-known instances of the olecranon and patella. A humerus must be very fragile to be broken by the act of throwing, and even this would be only indirectly through the agency of the muscles. In dislocation, on the contrary, muscular action is all-important. A favorable condition, as regards position of the joint and the exercise of powerful muscles in the right direction, is all that is required to ensure displacement. Thus, the elevation of the arm throws much of the head of the humerus out of its shallow cavity, and the necessary consequence of the concurrent action of the latissimus dorsi and great pectoral muscles is to dislocate it downwards into the axilla. When the legs are widely separated, it is the glutei chiefly which throw the head of the femur into the foramen ovale. In like manner we may trace the way in which almost all dislocations are produced; and the practical lesson this knowledge teaches is, to direct our steps in accomplishing reduction. We may assume the following axioms respecting muscles in their relation to joints: 1. That they are important agents in preserving their integrity. 2. That under favouring circumstances, they are the chief instruments in producing dislocation. 3. That they resist reduction; and 4. That they contribute to effect replacement of the bone, if the surgeon favours this help by the relation in which he places the head of the bone and the cavity from which it has been displaced.

In examining injuries either with eye or hand, the greatest assistance is obtained by a careful, and if possible *simultaneous* comparison of the healthy with the injured side. Any deviation from symmetry is thus most readily detected. For instance, in suspected injury to the shoulder-joint, by standing

behind a patient and carrying both hands simultaneously over the outline of each clavicle, acromion and spine of the scapula, the attention would be immediately arrested by any difference between the two sides.

On Railway Accidents.—With the manifest advantages which our railways confer they are responsible for a certain amount of physical injury to their passengers, and also for much demoralisation, of which they are at once the unwilling cause and victims. Railway injuries may be classified under the two heads of those which are genuine and those which are either assumed or grossly exaggerated; and if from the former we deduct those cases which have no peculiarity as associated with railways, the residue is extremely small in which specific railway concussion occurs. To be in a railway collision is esteemed a great boon by many; for every facility is afforded to the unscrupulous claimant to obtain large compensation for asserted injury, supported only by subjective symptoms, which the medical adviser of the Company is invited, either politely or with effrontery as the case may be, to explain or refute; and a suggestion that the symptoms are assumed or even exaggerated excites sympathy rather than credence. It is truly humiliating to witness such scenes, which are so constantly brought under the notice of consulting surgeons to railway companies; and there seems to be no remedy for this state of things but that which I have elsewhere suggested, that every litigated case should go before a tribunal of qualified medical men, who should hear and decide on the medical evidence which shall be placed before the judge and jury. However, I wish only to speak of the observed effects of genuine railway concussion, as they have come under my observation in several years of opportunity that have been furnished to me by one of these special appointments.

In many, perhaps in most, instances the physical shock is exaggerated and complicated by its moral effects. The alarm, the consciousness of severe injury escaped, and the dread of future risk weigh heavily on the patient, and lend an importance to local suffering of which these symptoms are assumed to measure the gravity. It is not to be denied that this induced state of feeling is a real element in the suffering entailed; but this “nervousness,” as a natural consequence of

an accident, should be regarded separately and not as symptomatic of the physical injury; yet, before a legal tribunal, it is next to impossible to enforce this distinction, and with the patient it is not to be expected.

Formerly all the general consequences of a railway accident were attributed to concussion of the spine; but, as I presume this is found to be untenable, the explanation now put forward is usually of a different nature.

I have no doubt that in some instances—though I believe they are comparatively rare—there is genuine concussion of the spinal cord; but their formerly assumed frequency was due to the common symptom of localised, or even general, tenderness and pain in the spinal column. I am satisfied that this is often caused by a twist or strain of the column, and in no way associated with any injury to the cord. Concussion of the cord is the consequence of a shock to the whole back, such as occurs when a passenger is thrown with violence against the back of the carriage; and in these cases not infrequently the more serious symptoms develop themselves at a later period, affecting especially but not exclusively the lower extremities. This condition is certainly the most serious and may entail lasting consequences, branching out in various directions by secondary implications. But observation has taught me not to attach much importance to spinal tenderness, whether local or general, if unattended by recognisable symptoms of nervous injury.

By far the most common form of real injury I have met with is what is termed “general nervous shock;” and this is usually—I may say always—so much associated with mental disturbance, that it is difficult to distinguish between the actual and the exaggerated, the real and the imaginary. Whether or not the cerebro-spinal system be primarily or chiefly involved in this shock, the symptoms usually indicate the cyclo-ganglionic system as that which is afterwards chiefly affected. All the organic functions are more or less disordered; the machinery is thrown out of gear, and one organ sympathises with another, and the patient is consequently more or less miserable. The heart’s action is generally feeble, quick, and irritable; the stomach sometimes disposed to reject its contents, and the digestive power weak; the bowels generally

inert; the liver inactive; the urine sometimes abundant and pale, at other times loaded with lithates. All sorts of anomalous sensations, sometimes pains, are complained of; there is an indisposition to move about or to occupy the mind, which symptoms are soon exaggerated, by indulgence, into muscular disability and mental failure. Disturbed rest, distressing dreams, failing eyesight or hearing, strange sights and sounds, offensive tastes and odours, loss of memory, giddiness, coldness of the extremities, depression of spirits, and many other symptoms of the same class supervene, for which the organic, including the vaso-motor nerves, are responsible, either primarily or exclusively. It is worthy of remark that the majority of these cases are treated by tonics, a generous diet, and stimulants in some form; moreover, strict rest of body and abstinence from all mental exercise are enjoined. Yet it seems to me that such management is at variance with reason as well as sound medical practice; indeed, it would be difficult to devise any plan of treatment better calculated to aggravate the symptoms; especially as the patient has a strong motive for nursing them, in the prospect of a liberal compensation for his injuries. Believing as I do, that the ganglionic system is the seat of this disturbance, and that a morbid state of mind serves to enhance the suffering of the patient, I am satisfied the proper treatment is almost purely hygienic for the body and cheerful encouragement for the mind. It is singular, in this *enlightened* age, how much the prejudice in favour of high living and tonics for "weakness" still prevails. Yet, what can be more hurtful than to stimulate an irritable heart, or mischievous than to load a stomach with food it cannot digest? Not less injurious is it to nurse the moping melancholy of the patient by bidding him to be idle, bodily and mentally, and thus leaving him a prey to his morbid feelings and fancies. If these injuries were self-inflicted, and there was no prospect of gain from them, their results would be very different, as I have occasionally noticed in those honorable exceptions where no compensation, or only a fair equivalent for the injury sustained, has been sought. In some more persistent and serious cases, the cerebro-spinal centre becomes more evidently involved, as exemplified in local or general hyperæsthesia, numbness and formication, cramp and imperfect

co-ordinating power in walking. In several instances I have been informed that there was sexual incapacity, with absence of sexual desire. Difficulty in micturition is rare. Many of these symptoms are more or less suggestive of that neuro-cachectic condition which, for lack of a more comprehensive name, we denominate "hysteria." Every circumstance, in short, whether external to the patient or in his own condition, conspires to exaggerate the really existing trouble; and it need scarcely excite surprise that, in a neurotic subject, the indulgence and cultivation of morbid feelings and fancies should culminate in a chronic state of depressed vitality, both bodily and mental, which an effort at an early period would have sufficed to mitigate if not to neutralise. Besides hygienic treatment, including plenty of fresh air and cheerful, encouraging surroundings, I am not aware that medicine is of much value in these cases. Nerve-tonics are helpful; but nothing, in my experience, hastens the cure so much as the removal of suspense by a settlement of the claim for compensation.

One word respecting habitual railway travelling. We are often asked whether it is injurious. Now, there are many inquiries to be made before this question can be answered satisfactorily. Health, temperament, occupation, distance, and frequency of trains are some of the more important elements for consideration. Persons in feeble health and of nervous temperament would do well to avoid a daily journey by railway. I am persuaded that, in such circumstances, serious mischief is often the result of hurrying to be in time for a train, especially when necessary business has to be compressed into a given period to accomplish the desired journey. Work is done under pressure and a constantly present sense of anxiety as the hours pass by; and this harassing care is enhanced if the distance be great and the trains few and far between. The heart becomes irritable, and a hurried walk or run to "catch the train" produces excitement and exhaustion which the journey does not serve to mitigate. If the heart be feeble—not to say organically diseased—the consequences may be and have been even fatal.

The motion of railway travelling, though apparently easy, is often prejudicial. It is not the rough, unequal jolting of the road, but a constant vibration which especially affects

some people. I remember a friend of mine, whose special experience enabled him to express the opinion, told me that this jarring of the frame was more likely to produce miscarriage than road travelling. I believe that eggs sent by train, if not properly protected, fail to produce chickens. The use of an air or water cushion obviates much of this objectionable vibration, especially if the support extend also behind the back.

A fall on the platform, in descending from a carriage, is not infrequent. May not this arise, in some instances, from the habit of sitting cross-legged, whereby the upper limb becomes temporarily disabled from pressure on the popliteal nerves? The leg "goes to sleep," and in the hurry of getting out, this is not perceived until the loss of power is proved by the impotence of the limb to support the weight. I have experienced this contingency, and it is well to be aware of it. This form of accident has, not improbably, figured amongst others, with no better justification, as a claim for compensation against a railway company.

Ought travellers to read in a train? Some say they cannot. I think it is preferable to employ the eyes thus than in looking out on the passing scene continually; the parallax motion of objects is very perplexing at times, and may produce giddiness and sickness. To the young and robust these remarks may appear trivial, perhaps ridiculous, but they are not addressed to such. The feeble or neurotic, and those whose mechanical elasticity is deteriorated by age, may be sensible, by personal experience, that a daily repetition of these small evils is not without a baneful influence on a rigid physical frame and a susceptible nervous system.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

(Continued from 'St. Thomas's Hospital Reports,' N.S., Vol. XIII, p. 26.)

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Note-taking.—Feigned diseases.—Use of the catheter.—Treatment of wounds.—Headache.—Varicose veins and Varicocele.—Heredity.

On Note-taking.—There is no knowledge, for practical use, to be compared with that which is acquired by personal observation. In the application of this remark to the practice of medicine or surgery I do not mean that he is the best practitioner who *only* accumulates precedents for future use. If he trusts to this sort of knowledge alone he will constantly find himself at a loss, when anything new is presented to him; but he must build up and afterwards fortify his principles by personal observation, aided of course by that which he has acquired from the recorded labours of his professional teachers and brethren. This learning is a life-long occupation; and the best method of conducting it should be acquired early, *i. e.* during student-life. Now, of the means of careful observation there is none more valuable than taking notes of cases; all our best practical works contain ample evidence of this; and

an opinion gains immensely in value where it can be supported by recorded cases.

Case-taking seems easy and simple, like many other things when they are well done ; but it really requires careful training and attention to rules. For the practical purposes to which I am referring, amplitude alone is not a desideratum : the history and notation of the various changes should be concise and clear. It is a common fault to encumber the notes of a case with too many details, and to give equal prominence and importance to trifles and to the salient and characteristic features of a disease or injury. It is a useful habit to record, from time to time, the impression on the mind which is made by special signs or symptoms in the progress of a case ;—to mark the influence which these indications have upon our opinion, in order that we may afterwards, retrospectively, judge of the correctness of our views : this, indeed, is a valuable element in self-education. Certainly a book should be kept in which to enter the rough notes taken on visiting a patient ; but this permanent record should not vary essentially from the original, except for the sake of clearness and precision. Indeed it is preferable to eschew altogether such rough notes as require copying ; and this may be accomplished by employing a definite-sized paper which can afterwards be preserved in a book or bound ; for freshly recorded impressions are generally more graphic and more true, than the same transferred, in an amplified and more polished form, into the book. It is remarkable how often, in thinking over a case, and dwelling on certain peculiarities, we are apt to modify our impressions, and not always for the better : for an undue value may be given to certain features in a case in the absence of others which equally impressed us in the presence of the patient ; and which were really entitled to as much consideration, if they had not been thus forced into the background.

There are certain headings which should be uniformly present in every case, such as name, age, occupation, habits, and general or special appearance of the patient : also the previous history and existing condition of the ailment for which advice is sought. It is desirable to keep separate the subjective and objective parts of a case ; in other

words the symptoms and signs: and when these notes are made, an expression of opinion, or diagnosis, should be recorded, for reference to in the future treatment. This suffices for the general run of cases; but in those of doubtful character, where the diagnosis is obscure or absolutely veiled, it is needful to be more particular in noting details, whether apparently important or otherwise: for our estimate of the value of signs or symptoms may be entirely at fault, until we have some key to their actual and relative diagnostic worth.

In the investigation of an injury the surgeon cannot be too particular in his inquiry as to how the accident occurred. The direction of a blow, the position of the limbs or body in falling; the character of the ground, the amount of momentum, or the interposition of any qualifying influence may aid importantly in the diagnosis. The soiled clothes of the patient often supply a hint, or even positive information to the surgeon, which he otherwise fails to obtain: for the alarm or confusion accompanying an accident often incapacitates the subject of it from giving an accurate or even a true account; and the testimony of bystanders, though not to be overlooked, cannot be always depended on. These suggestions may often be verified in dislocations, especially of the shoulder-joint, the diagnosis of which is much assisted by attention to these details; which should, therefore, be registered for future as well as present help. In injuries of the head we are often dependent on the information we thus obtain: *e.g.* the hardness or softness of the ground, with which the vertex comes in contact in a fall upon the head, may point to a fracture of the vault or the base of the skull; just as a fall on the palm of the outstretched arm or on the shoulder may suggest a dislocation or fracture of the neck of the humerus.

In many instances it is unnecessary to encumber the record with a daily entry, and superfluous to notice conditions in detail which are unvarying. But in others, even an hourly record may be desirable, as in the varying condition of pyæmia, where the temperature and state of the patient's secretions may be noted by an intelligent nurse. A note should be kept associating any particular change of treatment and its apparent or presumed result; and by comparing repeated observations of this sort, we learn to distinguish between the *post hoc* and the

propter hoc ;—between what is simple coincidence and what is related as cause and effect. Cases are worth taking if it be only for the practical value of the knowledge thus acquired.

In surgical as well as medical cases it is often desirable to make a note of any peculiarity of temperament, natural or acquired, or of any hereditary tendency which may exist ; but the value of these features varies greatly ; and too much importance must not be attached to the statements of patients or their friends on these points, as they are often misleading. Indeed this remark applies to the history of cases generally, and the surgeon must trust more to his own tact in eliciting information than to the gratuitous observations or conjectural assertions of others. It is always better to avoid leading questions in sifting a case, unless the nature of the circumstances renders such a course necessary ; and it is generally easier to compile the notes that are required from a narrative, than from answers to categorical questions, which are apt to be coloured by our own, perhaps premature, conclusions.

It is scarcely necessary to remark that, in criminal cases, it is imperatively requisite to note every particular, with much less regard to apparent relative importance. Notes of everything observed should be preserved in their original form, and without being transcribed ; and facts and opinions, if any of the latter are recorded, should be kept entirely separate. The best way, indeed, is to include no opinions in such original notes ; but to append them to any private memorandum that may be kept, and which is not intended for the public eye. Such impressions are, however, valuable whilst all the circumstances are fresh ; more valuable than after the lapse of time and the introduction of fresh elements into the case may have influenced our opinion.

The thoroughness with which post-mortems are made may depend very much on the nature of the case. A complete and critical examination of every viscus is necessarily tedious and occupies much time ; and for this and other obvious reasons is not expedient in private practice. For public record the investigation cannot be too searching ; but for private use it is generally sufficient to direct attention to the supposed seat of mischief. Negative results should, however, be noted : *i. e.* the absence of any morbid appearance in any organ

examined. The best record of the microscopic characteristics is the preservation of a specimen of the morbid product; or, in its absence, a sketch of appearances noticed. Indeed, this latter remark applies more generally in note-taking; for a good sketch expresses far more, and in a shorter compass, than notes: and, I may remark that some facility in this respect may be acquired, with a little practice, where the gift is not possessed naturally.

Feigned Diseases.—Shamming falls more under the notice of the physician than of the surgeon, because it is more easy to feign subjective than objective symptoms. The reasons for malingering are numerous; but the variety of forms it assumes is still greater. Many of these reasons may be traced; but the practitioner would err if he assumed that the absence of all apparent reason is conclusive as to the reality of the symptoms. Some of the most obstinate forms of shamming appear to be without any assignable motive, except it be the pleasure of deceiving, or that of a morbid desire to excite sympathy, to stimulate speculation, or to create surprise; motives which, to ordinary apprehension, bear no proportion to the self-inflicted suffering or confinement they entail.

In some instances the feigning may be only an exaggeration of some existing trouble, but for a very definite object, viz. gain. Of this class is a large proportion of the claimants for compensation after railway accidents. In truth this exaggeration seems to be conventionally accepted as honorable and honest; but it has a very demoralising influence on those who practise the deception and on all who uphold them. Exaggeration is naturally more difficult to expose than symptoms entirely coined by a patient; especially when, by repeated leading questions, he is prompted to answer in a consistent way. I believe that many persons are, in this way, induced to believe that from which, under other circumstances, their sense of truth would revolt.

The alliance between hysteria and malingering renders it difficult in many instances to dissociate them. Of course I recognise hysteria as a disease, and what I mean is, that hysterical people, both male and female—the subjects of neuro-cachexia if I may be allowed the word—are apt to be fanciful,

to exaggerate their symptoms, and to accept and even nurse any that are suggested to them. I suppose this is why hysteria is often regarded, popularly, as a controllable complaint, existing chiefly in the morbid imagination of the patient, and nourished by a craving for sympathy.

Generally speaking the reason for shamming is readily discoverable in men. There is some palpable object to be obtained, some direct pecuniary advantage, or escape from that which is disagreeable. But with women other and more hidden motives very often determine the deception; and the tact and ingenuity, as well as the knowledge and experience, of the medical attendant are often put to a severe test, where the fraud is artfully devised and tenaciously sustained. Every case will demand its own special management, and success will depend on the ability of the doctor to out-manœuvre the patient. He possesses certain advantages which, if used skilfully, generally suffice to unmask the shammer; but not always so: for the power of adaptation to circumstances manifested by these people, their adroitness in parrying attacks, and their sagacity in divining the object of the investigator, is sometimes as marvellous as their tenacity of purpose in adhering, amid surrounding difficulties, to the falsehood they are acting. The advantages to which I allude are, in the first place, an acquaintance with the probability of the history given of the origin and course of the asserted complaint; and also the consistency between the existing symptoms and what they are supposed to denote. A flaw may thus be discovered which would satisfy the surgeon that he has to deal with a feigned disease.

Many of the more ordinary physical signs by which a patient's condition is tested may be masked, such as general appearance and expression, the state of the tongue and of the secretions; but the pulse is not so easily influenced, if sufficient time has been allowed to elapse, in the doctor's presence, to permit any induced quickening of the heart's action to subside. During sleep the patient may betray the truth; and an anæsthetic is an admirable means of exposing any assumed deformity or malposition of a limb. It would not be difficult, but it is superfluous, to exemplify these remarks: but I would observe that great caution should be exercised in adopt-

ing any coarse or painful means of arriving at the truth. Where there is doubt it is expedient, as in legal matters, to give the patient the benefit of that uncertainty. It is one thing to apply the test of suffering to remove a doubt, and another to use some severity in order to compel a patient to acknowledge a detected deceit. Threats of such severity in a patient's hearing, but apparently not designed for him to hear, are often productive of the desired result.

One feigned disability, that of micturition, in females is, I fear, more often erotic than hysterical, and the indulgence simply fosters the deception. I have known the bladder enormously distended under these circumstances, where there was reason to believe the retention was voluntary; indeed, I suspect there are very few such cases where it is not so.

Use of the Catheter.—If I were asked for some simple test of manipulative dexterity in a surgeon, I should be disposed to name that of passing a catheter. Few things appear easier to the observer than this operation, when it is well done: but it is painful to witness the clumsy way in which this instrument is sometimes handled, regardless of the delicacy of the textures which are operated on, or of the relative anatomy of the structures invaded. Nay, the operation may be completed with the same apparent facility by two persons, and yet the patient will afterwards reject the services of one of them, and place himself in the hands of the other without hesitation. What is it that constitutes this difference? It is gentleness: and this quality is quite compatible with firmness where an obstacle is to be overcome. Roughness and ignorance may do, and have done, irreparable mischief, by mismanagement of a stricture or by laceration of a healthy urethra; and this arises as often from the employment of ill-selected instruments as from ignorance in using them.

The structure, capacity, curves and relations of the urethra ought to be most carefully studied throughout; but there are certain parts which are more important than others. I cannot say that I attach value to the muscularity of the urethral wall as an obstacle to the introduction of the catheter; but I think spasm of the accelerator urinæ muscle does sometimes act in this way, though not to an extent which may not be

overcome by a little patience and care, with gentle friction of the perinæum. I believe also that the prostatic portion of the passage may be contracted through the agency of the muscular organ which surrounds it. In both cases the stimulus is the presence of the catheter, and the action is reflex and not long sustained. Doubtless the anterior fibres of the levator ani may be similarly excited to act. I do not, however, believe that this active obstruction is enduring, though I am convinced that hasty efforts to overcome it are fraught with mischief.

The passage then to and through the bulb is simple and easy where no stricture exists ; but immediately beyond this point the inexperienced operator gets into difficulty. The trouble he experiences arises from a combination of causes. The urethra becomes slightly contracted here, though not sufficiently to arrest the progress of the instrument : but it is fixed and suspended in close proximity to the junction of the pubic bones ; and the curve of the canal at this point is rather sharp : therefore, if the handle of the catheter be depressed too soon its point is driven against the pubic arch ; and, if violence be used, injury to the passage is likely to accompany failure, when a metal instrument, especially one of small size, is employed. This is a recognised cause, indeed it is the usual explanation, of the miscarriage of this simple but delicate operation, whatever may be the reason assigned by the operator. Certainly the most convenient position in which to pass a catheter is the upright one, the patient standing with his back against a wall. If the patient be nervous and likely to faint, of course this posture would be unsuitable. If recumbent, the legs should be well separated, and the posture perfectly straight. A metal instrument should be warmed and well oiled, and the penis should be drawn forwards to keep the canal on the stretch, whilst the catheter glides along it, till the handle begins to fall ; its point being, meanwhile, pressed gently against the lower wall of the passage. If there be any obstruction at this stage I invariably place my forefinger in the perinæum to guide the catheter ; and carry the finger, onward, within the sphincter, till the bladder is reached : for the course of a metal instrument may be generally traced through the prostate.

When I was young metallic catheters were used almost

exclusively : but usually the gum elastic instrument is to be preferred as safer and as easy to pass. It is with small silver instruments that most mischief is done : happily the results of laceration are not so often serious as might be anticipated ; I suppose because the valvular form of the injury to the mucous membrane does not readily permit extravasation to take place : but slow, insidious infiltration of the submucous areolar tissue, with walled-in perinæal abscess, is the more common sequence when mischief does result. I may remark that the amount of injury is not to be measured by the blood that is lost on these occasions, for some patients will bleed very freely where no violence is used, and where no serious injury can have been inflicted : and the converse is also the case.

I have no intention of dealing with the subject of permanent stricture ; but will just glance at two or three forms of obstruction demanding speedy mechanical or operative interference.

A common and troublesome class of cases requiring assistance is that in which sudden retention, or, more strictly, sudden incapacity to micturate occurs in the subject of a permanent stricture. The patient will probably state that he was able to pass his water previously, though in a contracted or tortuous stream, and on further investigation it will be found that he has probably been indulging too freely in wine or beer, and neglected to attend to the demands of nature, until he found that he was unable to relieve himself. What is the explanation of such a case ? It is generally attributed to spasm superadded to organic stricture. There may be, and I think there frequently is, some spasm of the accelerator muscle, but I do not believe this constitutes the obstruction which is often met with in passing a catheter of any form or size. The inability to micturate is chiefly due to over-distension of a neglected bladder and consequent loss of contractile power ; whilst the obstacle to the introduction of an instrument is a zigzag stricture, which permits the urine to flow in a stream, but is not accessible to a catheter which cannot adapt itself to the tortuosity of the canal. To afford relief in these cases, which is urgently needed, it is a common practice to recommend a warm bath and to give opium. Of the former I cannot say I entertain a high opinion : a hot fomen-

tation to the perinæum is equally serviceable. Opium, if given in a full dose, affords relief to suffering, but does not aid the surgeon. I have repeatedly tried belladonna to the perinæum, but with no marked result. Some instrument must be passed, and what is the best? A small catheter is necessary on account of the stricture; and if a small tapering elastic one can be coaxed through the obstruction this is the safest and best. Sometimes the sudden withdrawal of the catheter or bougie, after firm pressure against the stricture, will be followed by a stream of water. Small catgut bougies are sometimes employed as a guide along which a catheter may be passed; but I do not like them: they are apt to get entangled in the lacunæ of the urethra and thus lay the foundation of after-trouble. Sometimes a small silver catheter is necessary, and may prove available after other instruments have failed.

But if a catheter of any description cannot be passed, what is the alternative course? It is either to open the urethra in the perinæum, or to puncture the bladder from the rectum. The latter has the recommendation of being the simpler and easier operation; the former is to be commended as offering a favorable opportunity for the radical cure of the stricture, by its free division when the urethra is opened. Certain peculiarities which may appertain to each case would decide me as to which of these operations is preferable. If, for example, the stricture is complicated with perinæal abscess or an old fistula, I should prefer the perinæal section; likewise if the prostate is enlarged or otherwise diseased. But in a simple, uncomplicated case, where the organic stricture is not of very long standing, and the bladder is greatly distended, I think puncture by the rectum is preferable. For, it must be remembered that disuse of the urethra affords a favorable opportunity for the treatment of the stricture by instruments: indeed, its quiescent state alone promotes a cure. Obstinate, old or complicated organic stricture should be treated by perinæal section. This is most readily accomplished by passing a grooved staff down to the stricture and cutting upon it. A director should then be employed to guide the knife through the stricture. The usual custom is to pass a catheter and keep it in the bladder: but I do not generally adopt this

practice myself. If I can pass an elastic catheter readily into the bladder, I do so, and leave it there for a day or two and then remove it. I do not, however, attach much importance to this step, as the bladder is sure to empty itself through the perinæal opening; and I think the retention of a catheter beyond the first day or two positively injurious. Theoretically it seems the correct thing to supply a model on which a new segment of urethra may be moulded; but the fact is that nature resents such dictation, and prefers building according to her own notions. As the healing process advances, the occasional introduction of a large-sized instrument is beneficial.

I have but few words to say on the treatment of enlarged prostate, or rather the obstruction due to this condition. In most cases the difficulty is readily surmounted with patience and gentleness, and with proper instruments. I have never driven a tunnel through this enlarged organ, though I can imagine it might be justifiable in very rare and exceptional cases. The ordinary prostatic catheter of metal or gum generally passes with facility into the bladder; and that after repeated failures and sundry lacerations with small, short-curved catheters. In some instances the character of the hypertrophic growth renders the introduction of a large and long-curved instrument impracticable; and I have then found an elastic catheter, tapering towards its point, and with a conical bulb, the best adapted to overcome the difficulty, as it accommodates itself to the tortuosity of the canal. Indeed, I strongly recommend this form of catheter in other cases than such as I am alluding to: it is a safe and very useful instrument. It is wonderful how much rough treatment the prostate will tolerate without resentment. If it were more accessible its removal would have been brought, ere now, within the range of modern surgical achievements.

I would remark, in reference to the use of metallic instruments, that it is desirable to have silver catheters fitted with flat wooden handles. These have a twofold utility; they offer a firm hold, and thus enable the operator to graduate the amount of pressure he may think it requisite to employ; and, still more importantly, this arrangement facilitates the guidance of the distal extremity of the instrument, on which success in

its use so much depends : for the operator may be misled either by the crooked position of the patient, or by misdirection of the point of the catheter. He must not deviate from the median line at the critical sub-pubic or membranous part of the canal ; but must keep the point of the instrument against the lower wall of the urethra, and thus avoid striking against the arch of the pubes above, or getting entangled in the fibrous, suspensory fascia, known as the triangular ligament, on either side.

Treatment of Wounds.—The treatment of open wounds, whether the loss of texture be from mechanical or chemical injury or from ulceration, must be conducted on the same general principles, though there are certain considerations which deserve attention as regards the general or constitutional condition of the patient, which may indicate some modification in the employment of suitable remedies. The management of these simple, but often troublesome, lesions has often an empirical character, for want of due attention to the physiological condition of the parts concerned. I say physiological, because the actual state of an open wound is governed by the aptitude of the nutrient vessels to do their duty. I do not mean that this condition is a purely local one ; for, no doubt, the vaso-motor nerve-centres are potential agents : but it is by careful study of the vascular activity of an open wound that we can judge of its prospects and need of assistance.

The character of the discharge from a wound is generally a fair test of its activity, whether reparative or destructive. But this generic word is often employed very loosely, all discharge being regarded as a secretion ; whereas such is by no means the case. In spreading ulceration, without reparative effort, the moisture on the surface consists almost exclusively of tissue débris, mixed, perhaps, with serous exudation from the opened mouths of the capillaries. This molecular disintegration may assume the character of phagedæna, or the still more rapidly destructive stage of gangrene, in which the soddened mass is deprived more suddenly of vitality, and thus remains adherent to, and perhaps infects, the still living tissues in its neighbourhood. Whatever the character of the

destructive process, decomposition accompanies it, with all its attendant phenomena.

Now, although destruction and repair cannot go on simultaneously at the same spot, evidence of a reparative effort may be apparent in immediate proximity with that of disintegration. In that case the discharge, instead of being sanious and fœtid, assumes a mixed character, and includes some pus cells. The predominance of the one or the other may be accepted ordinarily as an index of the actual condition of the lesion, and also a safe guide in dealing with it.

Where there is rapid molecular death a powerful stimulant is required to rouse the part to action, as in the employment of strong nitric acid to the spreading breach in phagedæna. For this to be effective the surface should be first mopped dry in order to allow of the full action of the acid, and also to limit that action to the part to which it is applied. To what is the speedy and usually hearty response due? It is not a purely local appeal, but one made through the vaso-motor nerves to their centres, and thence reflected to the same part in renovated energy and renewed life. And so with all the modified forms of inactivity; the stimulus must correspond to the need, and wherever there is decomposition the application should be disinfectant as well as stimulating, and frequently renewed. Position and support are important elements in the treatment of ulcers or open wounds, especially where venous congestion was the favouring agent in the production of the lesion: indeed, these two essentials, if properly employed, generally suffice to cure most ulcers, unless the circumference be so indurated and changed in character and vitality, as to need removal by the knife or by caustic. I can speak very favorably of the india-rubber bandage, as efficient as well as cleanly; but it requires careful adjustment. Both posture and pressure prevent or reduce engorgement of the capillaries and veins, and thus render the circulation, and consequently the nutrition, more active.

It is needless to insist on the imperative necessity of cleanliness: yet this is often neglected. Gentleness is also requisite in dealing with a granulating surface, the delicate texture of which is too often violated by the rough use of sponge or lint. All the necessary cleansing may be accom-

plished by a gentle stream of warm water over the granulations. As regards local stimulants and disinfectants I give a preference to the old-fashioned chlorine preparations over the more modern carbolic acid treatment. Redundant granulations are dealt with more satisfactorily by pressure than by caustic.

I may here notice a condition which is occasionally met with after scald or burn. The surface presents the appearance of being covered by fine granulations and bedewed with pus, in such way as might readily mislead anyone not familiar with the appearance. On careful inspection, however, it will be seen that the granular surface consists really of the swollen and inflamed papillæ of the denuded cutis, the vessels of which pour out pus. Delicate protection of the highly sensitive surface is all that is needed, and the skin often recovers its healthy condition in a very short time.

For the speedy healing of simple incised wounds it is necessary to keep in view the required conditions. We have no reason for believing that the divided extremities of vessels are directly re-united, even if brought into almost immediate contact by the adaptation of the surfaces of an incised wound. The bleeding or tendency to bleed is arrested by the plugging of their mouths and a plastic deposit from the serum, through which new vessels shoot from side to side, and thus re-establish the circulation. From this consideration we learn that the interposition of any extraneous matter would interfere with this process; and that it is desirable to favour the deposition of the plastic film from the blood-serum. Now, coagulated blood acts as an extraneous body, and its presence mars the ready union of two cut surfaces, and is likely to induce suppuration, carbolic acid dressing notwithstanding. The practical conclusion is, that it is preferable to wait awhile, until hæmorrhage has ceased and serous oozing has replaced it, before closing an incised wound: and also to favour the coagulation of the albuminous deposit by some application, such as spirit and water, or a weak solution (about 1 part in 50) of chloride of zinc. In highly vascular parts, such as the lips, it is necessary to arrest the bleeding by immediate closure of the wound, excluding as far as possible all blood from between its surfaces.

If the healing of a punctured wound is not immediate, it generally causes trouble by the accumulation of discharge at its bottom, which has not a ready exit: the difficulty in healing being mechanical and similar to that which pertains to sinuses. The treatment should, therefore, be conducted on similar principles;—the widening of the mouth of a punctured wound often leading to the same satisfactory result. The retention of poison in a punctured wound is due to the mechanical obstacle to its escape: and the severe constitutional disturbance which occurs often in this form of wound, even where no poison has been introduced, may be traced to infection from the retained and decomposing secretion: at least such is my interpretation of what I have frequently witnessed.

Contused and lacerated wounds are often attended by loss of texture, when severe. I know of no specific treatment in their early stage, unless it be soothing and gentle support.

I have said little of the constitutional treatment of wounds, for this must be determined by circumstances outside the local lesion. Nature's indications must be attended to, as well as that which, proverbially, constitutes a second nature, viz. habit: in short, hygienic management guided by common sense, and with regard to the special necessities of each case.

On Headache.—I should not venture to write on this subject if personal experience had not quickened my interest in this form of suffering, and prompted me to watch and endeavour to relieve it in others. I do not propose to write on headache generally, but only on that form with which I am specially conversant as one of positive torture in its severer type, and, unhappily, almost beyond the pale of medicinal or even hygienic relief. And I will not stop to discuss whether what I am about to describe is the same as the French call "*migraine*:" but I fear it is sufficiently common amongst my hard-worked and anxious fellow-practitioners for me to have the sympathy of some of my readers in the description.

Generally these headaches are periodical, sometimes regularly so, and at varying intervals, but rarely more frequently than once in each week. The severity of the paroxysm and

its duration vary in different individuals: but all temperaments are subject to the attacks, whether bilious, nervous or sanguine; though the anxious and irritable more often suffer than the placid and even-tempered, the cause and effect being, probably, in a measure interchangeable in this respect. The middle period of life, say from thirty to fifty-five, is that during which the frequency and intensity of the suffering is usually greatest; and if life is prolonged, the attacks become gradually feebler and occur at longer intervals, until they cease almost entirely, or assume the mitigated form of a common headache.

I will first endeavour to trace the course of a severe and protracted paroxysm from its commencement to its close. After a night of, perhaps, unusually heavy sleep the patient rises unrefreshed and languid: a cloud seems to be hanging over him; even trivial occupations appear toilsome, and everything goes wrong. He eats his breakfast with indifference, and proceeds to the usual engagements of the day; but the darkness thickens, his temporal arteries begin to swell, his eyeballs become tender, and his incapacity for exertion of any kind is augmented. He strives to rouse himself, and the effort entails increased suffering, which may be limited to the front or back of the head or to one side, or it may involve the whole. Frequently the most intense pain seizes one eye, the globe seeming to be dragged back into the orbit: finally, the limit of endurance is reached, and the sufferer is driven to seek the only resource from aggravation of his torture in seclusion and darkness.

But the pain in the head, as I have described it, by no means expresses all that the patient has to bear. No words can so adequately describe the physical condition as by representing it as closely resembling the stage of sea-sickness preceding the act of vomiting, and plus the intense pain in the head: and this is accompanied by an almost hopeless sense of despair that relief will ever come. If the sufferer be well advised he will abstain from food, for, if he eat, fermentation instead of digestion ensues; and the common crisis of vomiting, which may be delayed for some hours, is only hastened and rendered more distressing by eating. This climax, though very common, is not invariable. When the

act of vomiting is inevitable, draughts of warm water certainly afford some relief by diminishing the exertion of retching. When unmixed with food the rejected fluid is of the most acrid acid character, but without bile, unless the vomiting is persistent; and then it would seem as if the pylorus relaxed its usual vigilance, and thus permitted bile to enter the stomach, where its presence is always resented. In some instances vomiting affords relief, especially where the presence of food is a cause of irritation; but in others the effort of retching only aggravates the suffering, and no alleviation is experienced until every trace of the acrid poison has quitted the stomach. Probably the relief obtained by drinking warm water may be in a measure due to the dilution of this irritating excretion. During these hours some patients can sleep; but more generally the time is passed in a semi-comatose condition, but without losing a consciousness of the suffering.

Preceding these attacks the urine is sometimes loaded with lithates, at other times it is abundant and limpid: the latter condition almost invariably accompanies and follows the stage of suffering: the skin is dry; and the pulse slow. The outcome from the attack is generally preceded by sleep, and the sense of the relief, negative though it be, is a measure of the suffering, and an enjoyment which must be experienced to be understood.

What is the explanation of this condition, and how is it brought about? What are its remote and what the exciting causes? These questions land us in the field of speculation: I will answer them as far as I can. The periodicity—frequently at regular intervals—of these headaches is remarkable. It appears as if a storm were gradually gathering, until it burst, and then left a clear sky, and an immunity from a recurrence of the attack for an interval, which can be calculated on with tolerable certainty. The suspension of the natural gastric secretion, and the substitution of a concentrated acrid fluid seem to suggest the elimination of a poison from the circulation, as there is no other apparent source whence, in the absence of ingesta, this fluid can be derived. As regards predisposing causes, I have no doubt that fatigue and anxiety operate in hastening and intensifying these attacks, but are insufficient to account for them. Now, I have

certainly observed, in many instances, other evidence of a gouty tendency : viz. in the character of the urine ; in tenderness or swelling of the finger-joints ; in a proneness to rheumatic pains and to lumbago : and my conviction is that these are cases in which the gouty diathesis exists, and in which the elimination takes place by the stomach,—the poison causing, by its presence there, the distress and suffering which I have endeavoured to depict. I regret that I have never subjected the vomited fluid to analysis ; though probably the form in which the poison was rejected might not have been that of lithic acid or the lithates. There is an arrest or perversion of the organic chemistry in some stage of the process of assimilation, and this condition is the outcome.

The practical question of importance is whether any available means can be employed to curtail the paroxysm, which will sometimes last over twenty-four hours, or to mitigate the suffering. At an early stage free action of the skin will afford some relief ; and this may be obtained by keeping the feet and legs in hot water for a considerable time. It is rarely admissible to eat and drink, when the headache is fairly established, for the reason assigned, viz. that the food will only undergo fermentative decomposition. Guarana powder has been commended for its efficacy : and I have found green tea serviceable in affording some alleviation. Where vomiting seems imminent warm water should be taken to facilitate the act. But in spite of any or all these remedies the attack will run its course, and leave the subject of it with but little if any perceptible weakness or prostration as a consequence.

The prophylactic treatment is scarcely more satisfactory, though a neglect of ordinary hygienic management is sure to aggravate the attacks. Regularity in the action of the bowels is essential, and should be secured by some mild aperient, such as the comp. rhubarb pill, taken with the last meal when required. Regularity in diet, mealtime and exercise should be attended to ; and as much fresh air as possible should be breathed, and good ventilation provided for, both by day and night. Attention to the action of the skin I attach the greatest value to ; free daily ablution of the whole surface, and, where it can be borne, an occasional Turkish bath are very serviceable. I believe nothing tends to mitigate these

attacks so much as free perspiration, which should be secured daily if possible. It is of course idle to bid the anxious man to lay aside his cares; he will tell you he cannot change his nature: but such control as can be exercised is no doubt beneficial in this respect. Every man's special experience will enable him to determine what food and drink suit him best. In a general way I would say that nitrogenous food should be used in great moderation; that malt-liquor is decidedly prejudicial; and that vegetable acids, especially in rhubarb and tomatoes, do harm. But the mineral acids are the best tonics, if taken well diluted; say fifteen drops of nitro-hydroch. acid twice daily in half a tumbler or a tumbler of water. In anticipation of an attack a very useful combination of acetic extr. of colchicum, and watery extr. of aloes, each one grain, with three of rhubarb, may be taken in the form of a pill for a couple of nights in succession, and with advantage. Local applications are of little avail: the most efficacious in affording temporary relief are chloroform, or chloral hydrate and camphor rubbed down together, either preparation being applied over the course of the affected nerve on a piece of lint or flannel. I may remark that I have often noticed that the posterior branch of the second cervical nerve is the seat of acute suffering in its distribution over the occipital scalp, as well as the frontal branches of the fifth.

What is the proximate cause of the pain, which is clearly of a type that is called neuralgic? Certainly the vaso-motor influence is temporarily suspended, as manifested by the dilatation of the arteries of the scalp. Is the great meningeal artery similarly affected? It may be so, as these vessels are derived from the same source; and the frequent stupor accompanying the pain lends a probability to the idea. As vascular dilatation and suspended vaso-motor influence are allied, stimulation of the inert vaso-motor centres affords the best prospect of alleviating the suffering, though not of curing the disease. Locality and atmosphere seem to have but little direct influence over this complaint: probably the attacks are mitigated by a clear, dry air, and aggravated by the relaxing effect of a damp climate. The catamenial period does not seem specially favorable for the development of the paroxysms; and, as far as I have observed, both sexes are affected in-

differently. That these headaches are hereditary the many instances I have known do not allow me to doubt.

In conclusion, and in confirmation of what I have said previously on this point, I may remark that some striking examples have come under my notice, in which gout has been developed in its more recognised phases in the subjects of these headaches, at a period of life when the cranial suffering had abated or was altogether in abeyance. In one instance within my knowledge these attacks, in an aggravated form, ceased entirely on the development of progressive paraplegia, which terminated after some years in death.

Varicose veins and Varicocele.—Operations for the radical cure of these troublesome complaints should not be undertaken without a clear understanding on the part of the patient of the risk which is incurred by a comparatively trivial proceeding ; and an operation should not be recommended unless demanded by special circumstances or required by the patient. My reason for saying this is the serious consequences I have witnessed from phlebitis and pyæmia, and the absence of any security from these serious contingencies. Moreover the obliteration of varicose veins cannot be always ensured by operation, and the saphena requires to be ligatured in two or three or more places to secure this result, in consequence of the free communication between its valveless branches. The best method of attaining the desired end is to pass a needle beneath the vein and to place a pad of lint or a piece of bougie over it, and then to compress the vein with a figure-of-eight ligature round both. The skin is thus secured from injury except at the needle punctures. The vein may be divided subcutaneously between the ligatures, but this is not essential. Of course the needle should be removed before ulceration commences, and the case should be watched. The pin or needle (a harelip pin is the best) may be left for forty-eight hours if there be no marked irritation. There is no more risk in the application of two or three pins than of one pin. If further security be sought by subcutaneous section of the vein, it should be done between the two ligatures nearest to the heart, and its object would be to diminish the risk of any clot being conveyed centripetally. I have

found this a tolerably safe operation if carefully done and watched.

Operations for varicocele often entail troublesome complications, even locally. The bundle of veins and laxity of the scrotal integument do not admit of the treatment just described. The varicose mass must be exposed, and compressed with a wire suture; but, I repeat, the cases are few in which this radical cure justifies the risk. Where atrophy of the testicle exists as a consequence of the varicosity, obliteration of the veins, even if the spermatic artery escape, will not restore it. It seems singular that we can operate with comparative impunity on the hæmorrhoidal veins. Probably this may be due to their termination in the portal circulation.

Heredity.—Heredity is a universal law of life: the two are inseparable. Wherever life exists heredity is stamped thereon. It is an ultimate law so far as science can trace it: reference to other laws or to the microscope fail to throw further light upon it: like engenders like; but why it is so we do not know save that it is a necessity. All bioplasm seems identical: we know not why the acorn can produce only the oak, or why the impregnated human ovum has within it all the potentialities of a perfect man. The stamp and impress are natural—the gift of creative power. And this heredity is not limited to species; it extends to individual peculiarities which are capable of transmission, and, therefore, of being influenced by external circumstances, either spontaneous or determined by man's agency. Beyond this heredity expands its domain into morbid actions, and it is a rife agent in the production and spread of degrading and destructive physical evils in the world, affecting especially the human race, and rarely perpetuated in animals except through the instrumentality of man.

It is an interesting and important inquiry how far this heredity of disease is capable of being influenced by circumstances, such as the acquirement by transmission or primarily; the period of life at which the disease was acquired; the influence of medical treatment in securing immunity to the next generation. Other questions of interest present themselves in connection with this subject, viz. the relative influence of male and female parents; the reproduction of hereditary disease

after the intervention of a healthy generation, and the explanation thereof; the influence of consanguinity; and also that of general debility in either sex. These are questions which can be satisfactorily answered only by the aid of extended investigation, statistically arranged. I can give no more than the results of my own observation, and write rather to stimulate others to direct their researches into this channel, and to preserve a record of all they observe, which I have failed to do.

The conditions of environment—giving a wide interpretation to the word—must influence heredity in a varying degree, according to circumstances. What is the extent of its agency on the impregnated ovum within the matrix? We have proof that maternal impressions are conveyed to and stamped upon the embryo or foetus during its growth, but we do not know how far its surroundings determine or even modify the earliest stages of its development. If, for example, the impregnated ovum of a flesh-feeding animal could be transplanted to the prepared matrix of a ruminant and there undergo development, would there be any modification of type as a consequence of such transfer? If such an experiment were practicable, we should have an answer to the inquiry; but I apprehend that answer would be in the negative; that the type would remain essentially the same with certain minor modifications, such as we know the parental source of nutriment and growth capable of producing.

The environment of some plants modifies their development, not only in the influence it exercises in regard to size and healthiness, but also in the duplex character and colour of their petals. Yet the type is unchanged, and the plant resumes its original form when the causes of deviation are removed. Precisely the same occurs in animals by crossing of breeds, feeding and training: but there is nothing to lead us to suppose that any influence save impregnation can change the type.

When both parents possess the "*mens sana in corpore sano*" the children are almost certain to be healthy, barring any previously inherited tendency or the occurrence of any accidental cause of deterioration during pregnancy. If one parent is healthy and the other feeble and sickly, but without specific disease, the offspring, I think, generally takes after one or other parent: thus, in a family of several children so begotten,

the hereditary influence of the parents will not be seen uniformly distributed ; but some of them will be strong and others feeble, following also other peculiarities which may exist in either parent ; girls more often taking after the father and boys after the mother : for I think there can be no doubt that the child more frequently inherits the characteristics of one parent than a combination of the characteristics of both, except the races be different, when the physical peculiarities are generally, but not always, conjoined in the offspring. These remarks are illustrated in animals as well as in man.

Personal resemblance is a familiar but striking feature of heredity ; and this repetition of form and face, or some particular feature, is quite as frequently derived from the father as the mother ; and therefore must be due to the primitive influence exercised on the ovum ; unless, indeed, it be argued that the impression is imparted through the mother during pregnancy, which is claiming much for mental influence ; I do not say too much. The close resemblance usually of twins is a remarkable and interesting feature associated with this subject ; but we cannot derive much information from the circumstance, as it may be explained, with equal plausibility, by referring it to a primary and simultaneous impression at the time of impregnation, or an identity of maternal influence exercised during pregnancy.

But mental and emotional characteristics are also transmitted from parent to child, and are manifested quite independently of education or imitation. Here, too, opposing qualities in either parent usually find expression in their offspring separately, and more rarely in alliance. In the same way the taste for music, drawing, mechanism ; and many other proclivities are no doubt frequently inherited, though imitation and early cultivation often exercise a material influence in the development of that which might otherwise remain latent. How intellectual gifts are distributed, and from which parent they are chiefly derived, I am not prepared to say, though I am disposed to believe that the privilege of conferring these gifts is shared equally by both sexes. It has been remarked that great men usually have had clever mothers ; and also that the sons of great and good men are often a discredit to their fathers. I think both these statements have

much truth in them : but the chief explanation is to be sought in other directions than in heredity. Many great men have gratefully avowed how much they owe to the judicious devotion and early training of a clever mother ; and many a scape-grace son might, with some show of reason, accuse his father of domestic neglect and indifference amid the absorbing claims of high station or public benevolence.

Certain physical peculiarities, which manifest themselves after maturity, are also inherited ; such as baldness or early loss of colour in the hair, tendency to obesity or the reverse, long preservation or premature decay of the teeth, &c.

Among the most singular of these transmitted characteristics are those which may be classed as habits, and which are specially under the control of the muscular system. For example, some singularity of gait, such as turning one or both feet in or out ; certain expressions of the face associated with some particular act ; manner of handling things, mode of standing ; and innumerable small habits and eccentricities, of which the observation of most persons can supply instances, and which serve to identify parent and offspring.

It is true that some of these peculiarities may be acquired by imitation ; but I am satisfied that very many are entirely independent of it ; moreover, these habits may be occasionally traced to a preceding generation, where imitation would have been out of the question.

It may be a question whether mental cultivation, in early life, in some particular direction and due to assiduous training, is capable of transmission to offspring. I am disposed to think that it is so ; though I am aware that instances which might be adduced in favour of this view are open to the interpretation that the result may be attributed to inherited natural ability or special proclivity, or to example or teaching. A parallel exemplification may be cited amongst the lower animals ; for I believe I am correct in saying that the offspring of dogs carefully trained for the chase manifest a greater aptitude and are more easily educated for the pursuit of game, than the offspring of untrained animals of the same breed. Again, the inherited aptness, in some families, for certain pursuits requiring mental culture or dexterity, may be ascribed, in part at least, to the same cause : and there can be little

doubt, I apprehend, that national characteristics are, to a considerable extent, due to similar inheritance; that the habits of a civilised people mould their characters more than their natural characters determine their habits.

As pathological conditions or diseases may be either inherited or directly acquired, it is an interesting question whether the former, or latter (if transmissible), are more readily transmitted to the next generation. As regards anatomical or physiological peculiarities, probably those which are inherited are more commonly perpetuated than those which are primary or, so to speak, accidental: the stamp is, as it were, so impressed as to become more or less permanent. Thus, I have traced an abnormality in the course of the radial artery at the wrist—the trunk occupying the place of the superficialis volæ—through four successive generations. Under the same head may be included defects and deformities, resulting often from arrested development, such as hare-lip and cleft palate; also deafness, shortsightedness, and some abnormal developments and imperfections, especially those affecting the hands and feet.

But the transmissibility of disease depends probably more on its activity at the time of procreation than on its inheritance or acquirement: and this is a consideration of great importance as regards the medical or hygienic treatment of those who are likely to transmit disease to their offspring. I think there can be little doubt that acquired disease is more amenable to treatment than that which is inherited; for, in the latter case, there is deteriorated vigour transmitted with the special pathological condition, and consequently there is less recuperative power, a feebler response to the medicinal appeal.

The many pathological conditions credited with heredity may, probably, be classified under but few heads, as most of them are only different phases of the same morbid action, modified by accidental peculiarities in the diathesis of the recipient. Inherited tubercle may thus manifest itself under different forms in various members of the same family; its active development in external organs often securing to the sufferer immunity from the more serious and even fatal invasion of vital organs. Moreover, the disease would seem to be

capable of exhausting itself by assuming an active form in early life, and of thus leaving the subject of such eliminative action comparatively robust, and competent to reach to average longevity. And here an interesting inquiry presents itself, whether, after such active expenditure, the original contamination of the system would be inherited. I think probably not in the case of tubercle more than in syphilis, unless the disease still exist in some latent form, which the absence of any exciting cause has rendered inert. The probable infectiousness of tubercle opens up a new field for speculation and investigation, of much practical value and interest.

Gout or—to use a more generic term—lithiasis is inherited in various forms, which include not only the many phases in which it is familiarly recognised, but probably also urinary calculus, carbuncle, eczema and other forms of skin disease, periodic headache, dyspepsia, &c.

Insanity is unquestionably hereditary; but it is a form of heredity involved in more obscurity than the others to which I have alluded; *i. e.* as distinguished from those conditions of impaired or disordered function which are due to the presence of tubercle, and liable to assume an active state and to terminate fatally. But disorders of the mind are, like many bodily ailments, the functional expression of an organic deviation from a healthy standard. We cannot suppose that insanity is transmitted from parent to child independently of organic change.

Cancer is credited, both professionally and popularly, with heredity. That it is so in some—perhaps many—instances is no doubt true; but, in my experience, not so commonly as seems to be generally assumed. The disease is comparatively rare in early life, and when so met with it is scarcely ever inherited. Probably it would be found that, in this disease, the developed presence of the morbid condition, and its activity at the time of impregnation, determine its heredity. That in some instances this disease manifests itself locally, and at once exhausts its tendency to further development, after careful and entire extirpation, there can be no doubt: yet these exceptional cases—for such they are—do not militate against the overwhelming evidence in favour of the constitutional origin of the

disease. There is nothing inconsistent with pathology in the supposition that, whatever may have been the predisposing or exciting cause of cancer, this cause may have been limited at first, and eradicable; but fatal if left to contaminate the system, probably through the lymphatics. I can recall some remarkable cases illustrating the suppression of malignant growth by early removal: especially one of typical colloid from the neck, and another of round-celled sarcoma infiltrating muscle, and recurring after one operation, the subjects in each instance (ladies and personal friends) being quite well after the lapse of many years. In these, as I believe it is in a large proportion, if not all, of such satisfactory cases, the disease was not hereditary. Again, instances of the most rapid development and speedy fatality of cancer which have come under my notice have occurred in children without any trace of inherited taint.

Such considerations need not, therefore, encumber the investigation into the origin and evolution of this terrible scourge, which spares neither age nor sex, nor temperament;—the sanguineous and lymphatic, the nervous and bilious being alike obnoxious to its ravages; nay, often the apparently healthy and robust become its victims without a trace of hereditary taint: and the “malignant aspect” is acquired only as the evolution of the disease advances. It is a pathological mystery which has baffled scrutiny beyond the circumscribed limit of its histology; a mystery which may some day be solved by light thrown, perhaps accidentally, upon it, by researches in humoral pathology, when the essentially constitutional origin of the morbid action will be demonstrated, and that its local manifestation is not determined by mere accident or caprice. It is worth having life before one to take part in such research, and to strive after the means of arresting the development of this remorseless disease.

The subject of hereditary syphilis has received much consideration from various observers. In this disease we have the best illustration of the power of medical treatment in extinguishing the activity of the poison, and, it may be hoped, therewith its heredity. The specific poison, if active at the time of impregnation in the mother, is developed in the offspring at birth in one or more of its secondary phases:

and in whatever form it may be inherited from either parent, it is perpetuated in blighted health and deteriorated development in after generations. Is inherited syphilis any security against the reception of the poison in its primary form? I cannot answer this question from my own experience. The alliance of syphilis and tubercle is a prolific source of misery both present and future; and when combined, as my early recollections remind me, with the effects of the reckless use of mercury, the objects of this triple infliction were both loathsome and pitiable in the extreme. I have little doubt that exfoliation of the flat bones and other complications, such as acute phagedena, were due, in such cases, rather to the abuse of the mineral than to the specific disease *per se*. This by the way.

There are many collateral questions of much interest associated with the general subject of heredity; such as the relative influence of male and female parent under ordinary circumstances: the same question when the disturbing element of disparity in age, physical power and habits is considered: the influence of consanguinity in parents; and that of the nurse's milk, if any, on the child.

The children of aged men, when the mother is young, are generally robust, if both parents are healthy; in other words, the age of the male does not seem generally to exercise a deteriorating influence on the offspring: at least such is my impression from what I have observed. And when the female is approaching the barren period of life she is able to bear healthy children if the male is vigorous and not old. But generally the offspring of an aged man and of a woman past the prime of life are not strong. Habitual intemperance in either parent has usually a disastrous influence on their offspring. I believe that this vice in the male has a more widespread power for mischief than is generally attributed to it; causing much misery in the succeeding generation, which manifests itself in various forms of deteriorated mental and bodily health, as well, possibly, as in the inheritance of the vice itself: at least so it is thought by some, though it is difficult to differentiate between the influence of example and heredity in this case. It seems, indeed, far from improbable that the predisposing cause of some specific degeneration may have its

origin in such constitutional degradation : tubercle, gout and, possibly, cancer may be thus initiated under favouring circumstances ; for we are not yet in a position to affirm that these pathological conditions are derived necessarily from any extrinsic source, and certainly they are not, in their specific form, necessarily hereditary.

The degenerative influence of consanguinity in parents is mysterious yet general : and this is not limited to functional deterioration, but appears to be a ripe source of organic imperfection. Yet this is not by any means universal, for many instances come under notice in which the families of first cousins are healthy and strong.

The question has been raised whether any influence is exercised on the sucking child by the nurse's milk ;—I mean such influence as could be regarded as distinctly hereditary, apart from mere physical vigour. I have no experience on this point ; but I can conceive it quite within the range of possibility that it is so ; and I should be disposed to allow this feeling to have some—I do not say much—weight with me in selecting a wet-nurse.

The singular circumstance of recurring heredity after the intervention of a generation, in some instances, deserves a passing notice. This is not only a popular belief, but is supported by scientific observation. It cannot be denied that, in some unintelligible way, the male influence survives the actual impregnation, as demonstrated in animals where it can be more readily traced. I presume that such intermittent heredity as that to which I refer is accounted for on parallel lines : it seems to admit of no other explanation.

The foregoing brief remarks on a large and interesting subject might be readily expanded into a volume, especially if authorities were searched and quoted. But in this, as in the preceding papers, I have simply given, in a suggestive form, the results of my own observation, without reference to the opinions of others. I trust some one or more of my younger readers may be induced, by what I have written, to cultivate a field which promises so rich a harvest ;—not in the loose and cursory way in which I have done it, but by the accumulation of facts, and by marshalling them in such form as to

render them available for the furtherance of our scientific knowledge, and in promoting the general welfare.

Since writing this paper the following interesting case has been communicated to me by my friend and former pupil, Mr. Musson, of Clitheroe, as having recently occurred in his practice. It seems to exemplify, in a remarkable way, the influence of maternal emotion on the ovum; if regarded as a mere coincidence it is scarcely less remarkable.

A lady, about twenty years old, married three years, and with one child, had menstruated in August of last year, just before there was an exhibition in the town of the "two-headed Nightingale." She did not see this monster, but only a representation of her; and heard her much talked about, and thought a good deal about the possibility of her next child resembling this *lusus naturæ*. In the following month, September, the catamenia did not appear, and then she concluded she must have become pregnant just at the time these thoughts were occupying her mind. In February of the present year a six-months' foetus, very recently dead, was born, in every apparent particular resembling the exhibited monster. This foetus is now in the possession of Professor Macalister, of Cambridge, who has kindly supplied me with some particulars respecting its anatomy. He speaks of this monstrosity as being not uncommon among sheep but rare in man. The limbs are double: the skull and spinal column, with the brain and cord, are double; but the ribs of each thorax coalesce with those of the other, a sternum being present on either side. There are four lungs and a single malformed heart, a single œsophagus and a single stomach. The small intestine is single as far as where the duct of the umbilical vesicle originally came off; from that point downwards it is double. Both foetuses are females. Professor Macalister remarks that monstrosities of this kind arise from cleavage of a single ovum; and in the light of Hertwig's researches, the ovum seems to be influenced by the number of spermatozoa which pierce it.

It is somewhat singular that, just as these pages were going to the printer, my attention was drawn to a similar case and attributed to the same cause, reported in the 'Lancet'

for March 21st of this year by Mr. B. R. Johnston, of Birkenhead. His patient was forty-two years old, and the mother of ten children. She menstruated in March, 1884, and was delivered in January of this year of twin boys, connected together from the neck to the umbilicus, with one cord proceeding from an umbilicus common to both. The birth was a difficult one, and the twins were dead. She told her nurse that in March, 1884, which must have been before she conceived, she went to see the two-headed Nightingale and fainted at the sight. She seems to have expected her confinement in November, and said, in answer to a remark that she might have twins as she was going on so long, that she did not care if they were not Siamese twins. Such are the facts in these two authenticated cases: it is difficult to escape the conclusion that there is a relation of cause and effect between this premonitory dread and its fulfilment.

To be continued.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

(Continued from 'St. Thomas's Hospital Reports,' N.S., Vol. XIV, p. 31.)

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Treatment of surgical hæmorrhage.—The therapeutic action of heat and cold.—On Nature's methods of cure; viz. by elimination; by augmented, diminished or suspended functional activity; by partial sacrifice.—Compensation.

Treatment of Surgical Hæmorrhage.—Surgical hæmorrhage is understood as excluding loss of blood from sources which are inaccessible to surgical relief, such as the stomach, lungs or brain. I have no intention of writing an essay on this subject, but I propose simply to record my own experience in the use of the usual surgical means adopted in arresting hæmorrhage.

Loss of blood, such as comes within the province of the surgeon to treat, may result from various causes, and may occur under very different circumstances. The remedial means at his command are likewise various, and must be accommodated to the requirements of each case. We may, thus, have bleeding from an artery or a vein, or general

oozing from many invisible vessels ; the cause being injury by cutting, bruising, tearing or puncture, or from destruction of tissue by ulceration. To meet these various conditions, we have the ligature, torsion, compression, and other supplementary aids, such as styptics, cold, heat, position, rest, &c.

I am not sure that there is always a clear distinction made between reactionary and secondary hæmorrhage : and yet this is not a fanciful difference in nomenclature ; it is one of real practical importance.

By *reactionary* bleeding is meant that loss of blood which succeeds primary hæmorrhage, when the propelling power of the heart recovers from its enfeebled action consequent on the loss of its normal stimulus ; and probably vaso-motor constriction is simultaneously relaxed. The syncope, partial or complete, which ensues from copious bleeding, is nature's styptic method of sealing the mouths of divided vessels whilst at comparative rest ; and this is accomplished with the co-operation of the excito-motor contraction of the vessels,—the vaso-motor activity being probably manifested in syncope as in sleep, in an inverse ratio to that of the cerebro-spinal system. But when the restored action of the central pump reaches again the more distant parts of its dominion, the plugs are forced out, and reactionary hæmorrhage ensues.

True *secondary* hæmorrhage occurs later on, and is consequent on suspended repair of an injury, in which the earlier risk has been tided over, or from subsequent sloughing or ulceration involving vessels of greater or less magnitude. Of course either form of hæmorrhage, primary, reactionary or secondary, may be fatal. The *reactionary* form is rarely repeated if once controlled ; for the shock dependent on it is severe, and the recovery is gradual and slow, and not, as it were, with a bound, as sometimes in the first reaction. The period at which reactionary hæmorrhage may happen varies very much according to circumstances, so that no definite limit can be assigned to the possible occurrence of this contingency. The age and strength of the patient, the shock of an operation, the quantity and quality of the blood originally lost, and the time over which that loss was spread, as well as the condition of the vessels, have all an important bearing on the answer to this inquiry. Emotional shock, such as fear,

may depress the heart's action when the loss of blood has not been great; and then reaction may be early, when the emotional pressure is removed. As a general rule, the greater the original loss and the deeper the depression, the more tardy is the reaction, and therefore the less the probability of a renewal of the hæmorrhage. In ordinary cases reasonable security may be felt after the lapse of twenty-four to thirty-six hours: but the state of the pulse, and other evidences of returning activity of circulation must be taken into consideration, in judging of the likelihood of any recurrence of the bleeding. Of course these remarks apply with much greater force to arterial than to venous hæmorrhage.

Secondary hæmorrhage is almost always ushered in by some premonitory indications, both local and general, sufficiently suggestive, usually, to put the surgeon on his guard, though often so sudden as to defy his precautions. These indications are, general want of power and tone; an absence of recuperative effort, manifested by a feeble and irritable pulse; want of sleep, lack of appetite, &c.: and when these symptoms are combined with a sluggish, inactive condition of a wound, with unhealthy discharge, denoting waste of tissue rather than repair, there is considerable risk of secondary bleeding, especially in the neighbourhood of large vessels, the branches of which may be involved in the destructive process: yet it is remarkable how rarely the main arterial trunks are laid open by ulceration. Compound fractures, especially of the leg, are not infrequently the seat of such secondary hæmorrhage as I have described, where the subject of the injury manifests low reparative power. It is impossible to fix any limit to the time during which this may occur. Repair may proceed satisfactorily at first; and afterwards, in consequence of some untoward circumstance, affecting the patient's health, aided, perhaps, by an unwary movement or sudden excitement of the circulation, the dreaded mischief is done: dreaded, because patients in whom secondary hæmorrhage is likely to happen, often fall victims to a sudden and copious bleeding, in consequence of their lack of reactionary power, wherewith to rally from the shock.

Deligation of an artery to arrest bleeding has stood the test of long experience, since it superseded the barbarous use of

the cautery : and Hunter demonstrated its value when applied to an artery in its continuity. Though the object in each case is not, in one sense, identical, yet the result, as regards the effect upon the artery and the permanent arrest of the current of blood, is the same. There are few simple experiments which teach so much in an easy way as that of tying a fine twine or silk ligature round a piece of fresh artery ; yet the knowledge thus imparted is generally acquired at second hand. The clean cutting of the inner and middle coats of the vessel demonstrates their individuality, their structure, and their properties and uses, in a way which no reading can convey ; and it also suggests the very mode in which the permanent closure of the artery is effected. The retraction and contractility of the elastic tissue, as the first step in this direction, is easily displayed, and the resisting toughness of the outer coat is shown to be an essential condition in the satisfactory action of the ligature.

My experience in the use of *torsion*, as a substitute for the ligature where large vessels are concerned, is very limited : the fact is I have never had sufficient confidence to trust to it, especially as the ligature is rarely attended with any serious inconvenience. Yet twisting small arteries is not a modern introduction : it is a lesson we have learned from the comparative security from bleeding of torn vessels ; for what we do by torsion is an imitation of what is done by tearing an artery asunder ; viz. elongation of the tough fibrous coat beyond the friable and lacerated middle coat, which retracts ; whereby the formation of a plug in the mouth of the vessel is facilitated. I cannot say that I recognise any special advantage in *acupressure* : the ligature is certainly more secure.

The substitution of an animal ligature cut off close to the knot, for one of silk, is certainly a valuable innovation on the older practice. I should probably have saved, by this method, a case of axillary aneurism, in which the ligature on the subclavian artery was torn away by a refractory patient, when the wound was nearly healed, as narrated in my remarks on "ligature of arteries." By the use of these animal ligatures the wound heals more readily, and the risk of bleeding in the separation of the ligature is avoided. And this remark is

applicable, whether the artery be tied in its continuity or at its open mouth.

What becomes of these animal threads? Probably they are simply soluble in the surrounding tissues, and are removed like other effete, unrequired material. No satisfactory proof has been adduced of their being organised; by which I suppose is meant that this foreign texture is supplied with vessels, and identified with the living tissue around it. I would say further, that the weight of evidence seems to be in favour of the opinion that fibrinous deposits exist only for temporary purposes and are not organised, but are absorbed when the purpose of their presence is fulfilled. The same remark applies, with still more force, to the coagula with which injured blood-vessels are plugged. Clots are never organised.

Compression is often available for the arrest of hæmorrhage in various forms and circumstances. Sometimes it is employed only as a temporary expedient, as in amputation or until a bleeding artery can be tied; in other cases it is designed to supersede all other means, as in epistaxis or for the cure of aneurism. But many precautions are indispensable to render this remedy effectual; and, it is scarcely necessary to add, also an accurate knowledge of the anatomical relations of arterial trunks and of their communications with each other, whereby we become familiar with the best position at which to compress the trunk which supplies the bleeding vessel, and are enabled to avoid the futile attempt to control hæmorrhage by only diverting the current into collateral inosculating branches. Thus, the circulation through the upper or lower limbs may be restrained by compression of the trunks, respectively, against the first rib and the pubes: but it is useless to attempt this below the elbow or knee, where there are free communications between their branches.

Failures of this sort are not uncommon, with either ligature or compression, in bleeding wounds of the hand, where the current in both radial and ulnar arteries is interrupted; for the interosseal vessels will carry on the circulation. With a trustworthy assistant I prefer manual compression to the tourniquet in amputation; and I used to elevate the limb in order to empty the vessels, and thus reduce to a minimum

the first gush of blood: and this is still desirable, even with the use of Esmarch's admirable elastic bandage, when it is important to save every drop of blood. It is unnecessary to praise this simple but valuable contrivance, which is, moreover, of great assistance to the surgeon in protracted operations, where clearness of vision is requisite, such as the removal of a sequestrum from a cylindrical bone.

Where a *compress* is used to control hæmorrhage at the bleeding part it is essential to employ a suitable material, which shall adapt itself accurately to the inequalities of a wound, and also admit of removal with as little disturbance as possible. Sponge is in many respects appropriate for the former purpose, but its porous nature renders it unsuitable for the latter; as the blood will permeate its pores, and, on its removal, the fibrinous clot in the wound will be torn away. But if a sponge compress be covered with a piece of cambric or gauze this objection is obviated. For the same reason sponge should not be used for plugging the nostrils in epistaxis.

Uniform compression of a limb is also valuable in arresting hæmorrhage: but it must be really uniform, and should include the whole and every part of a limb below the seat of injury. Such treatment, however, requires careful watching, or the vitality of the member may be endangered.

Styptics are sometimes available where a ligature or compression cannot be employed. I cannot say I am disposed to attach much value to them as a class, though they are occasionally convenient. The perchloride of iron is probably the best, owing to its property of rapidly coagulating the blood with which it is brought in contact. Tannin is likewise useful; and I also value the somewhat old-fashioned remedy of matico leaves. Chloride of zinc in solution, as I have remarked in another paper, is efficacious in arresting surface bleeding, by favouring the coagulation of fibrin from the blood. Under certain circumstances the actual cautery is preferable to all styptics, as in hæmorrhage from a deep-seated cavity which is inaccessible to any other remedial interference. Of styptics taken internally I prefer lead with opium to any other; I think it more generally useful, but it must be given with caution.

Cold may very generally be employed with advantage in arresting hæmorrhage, either in the form of a lotion or of irrigation, or of ice. A stream of cold water, allowed to flow continuously over a bleeding part, is often effective, and is free from any objection : but it cannot be trusted alone, where vessels of any size are divided. Ice is more efficacious, and may be applied either directly to a wound, or wrapped in linen. Bleeding from the rectum may be controlled by the injection of iced water into a tubular bag, introduced into the bowel ; we have, in this way, pressure and cold combined.

If is scarcely necessary to add that *diet* is an important element in the treatment of hæmorrhage. Except under the pressure of necessity stimulants should be sparingly allowed or prohibited : but it is an error to assume that, in all cases, abstinence from nutritious food is desirable. On the contrary such food is often an essential part of the treatment ; not so much to supply the deficiency of blood occasioned by the loss, as to improve its quality, and thus diminish the risk of a recurrence of the bleeding.

The *position* of a bleeding part should be as elevated as practicable ; and *rest* should be in a comfortable position, which can, if necessary, be changed from time to time without disturbance.

The *hæmorrhagic diathesis* may be suspected where bleeding is persistent, and resists the control of ordinary remedies. The suspicion that it exists may generally be verified by questioning a patient as to the behaviour of trifling lesions attended by loss of blood. Small wounds are sometimes very troublesome in these cases : I have known bleeding from a tooth-socket, and even from a leech-bite so persistent as to blanch a patient. In epistaxis it is serious, for plugging the nostril is not always successful in permanently arresting the loss of blood, which is apt to recur when the plug is removed. A well-oiled pledget of lint forms the best plug : but this should not be neglected, as suppuration will ensue if it be left in too long. In bleeding from a tooth-socket a plug moistened with perchloride of iron is the best styptic : and if there be an opposing tooth, the jaws should be kept in contact with a bandage ; or, in the absence of such tooth, its place should be supplied by a suitable compress.

What is the explanation of this proneness to hæmorrhage in some persons? In some instances it may be due to the defective plasticity of the blood: but it is not improbable that deficient control on the part of the vaso-motor system is, in many cases, if not generally, the explanation of this singular phenomenon.

Punctured or penetrating wounds, involving vessels of any size, are difficult to manage, as, indeed, are all partially divided arteries. The muscularity and elasticity of their texture causes the wound to gape and prevents the formation of a plug. Therefore it is expedient, in some instances, where it is practicable, to complete the section of a partially divided artery, that its open mouth may then contract and retract. Where a large arterial trunk is implicated in a penetrating wound, prompt and decisive action is demanded. Such a wound of the brachial or femoral artery, or of their divisions, admits usually of but one mode of treatment, viz. exposure of the bleeding vessel, and the application of a ligature both above and below the wound in it. This is not always easy, for the extravasated blood displaces the surrounding textures and disguises the position of the vessel, which cannot be distinguished by its pulsation because of the necessary compression above to stop the circulation through it. Under these circumstances the simple expedient of passing a probe or a director along the track of the wound, and retaining it there, will be found a valuable guide to the operator in his search for the point of injury.

Sometimes it is inexpedient to attempt this mode of securing a wounded artery; *i. e.* where it is impossible to determine the exact source of hæmorrhage, and where search for the bleeding vessel is likely to involve the opening of others. This remark is exemplified in wounds of the palm of the hand or sole of the foot. It is true that, in these cases, we may know the source from which the bleeding proceeds; but the difficulty of detecting the bleeding point, and the risk of dividing other branches in the search, are almost insurmountable. Moreover, the inosculation between the branches of the several arteries is so free, as often to defy any attempt to arrest such hæmorrhage without applying a ligature on the supplying trunk. This remark is especially applicable where the palm

of the hand is the seat of persistent arterial bleeding. As already remarked, uniform pressure,—with Esmarch's bandage for example—may be successful in these cases.

In penetrating wounds of the neck it is difficult and, I think, injudicious, in many cases, to extend the wound for the purpose of searching for the bleeding vessel. Of course, if the direction of the wound lead to a reasonable conclusion that the carotid trunk is injured, then that vessel ought to be exposed and tied both above and below the bleeding point. But if the course of the wound be inwards, behind the angle of the jaw, it is impossible to say whether the bleeding is derived from the external carotid or any of its branches, or even from the internal carotid. In two cases of this description I tied the common carotid with entire success, and, fortunately, without the occurrence of any untoward cerebral symptoms.

The Therapeutic Action of Heat and Cold.—When we use the words “heat” and “cold” we employ them simply as signifying two opposite conditions; the latter being the negative of the former. But it is convenient to use the word “cold” as if it were a positive condition, to save circumlocution in writing on this subject.

In surgical treatment heat and cold are often employed indifferently, and not without some reason; for a similar result is obtained by their aid, though in a different way. But there is one rule by which to abide in the use of either, if its efficacy is to be tested, viz. that its employment should be continuous and not intermittent. In order to appreciate the action of heat and cold it is necessary to bear in mind the local vascular condition in the circumstances in which their aid is most frequently sought.

The blood-vessels must be regarded simply as conduits of nutriment throughout the body, but without any active part in growth. It is true that the delicate membranous channels which constitute the capillaries permit the transudation of liquor sanguinis for this purpose, and that these vessels remove effete matter and have the power of extending themselves by offshoots into new tissues; but these tissues grow by their own intrinsic power of development in their own germs.

It should be also remembered that the arteries are both

elastic and muscular, the latter property increasing and the former diminishing as they recede from the heart, *i. e.* as the vessels diminish in size and are less under the control of the heart's action. Lastly, and not least importantly, it should be borne in mind that these muscular arterioles are governed by the vaso-motor nerves, derived from cyclo-ganglionic centres, and distributed to these vessels to their termination in the capillaries. Arteries, therefore, are actively contractile, as well as distensible, owing to their elasticity; and veins possess the same properties, though in a much lower degree: but the valves of healthy veins play an important part in diminishing any tendency to engorgement which may exist.

It will suffice to add that the first observable sign of inflammation is capillary stagnation, immediately succeeded by exudation of the liquor sanguinis, and followed by an increase in the local supply of blood, which is coincident with dilatation or augmentation of the calibre of both arteries and veins in the affected part, and a relaxed condition of the capillaries. Whilst this dilatation is proceeding the blood-current first increases in rapidity, then gradually slackens and becomes irregular, and finally stops; thus capillary *stasis* is produced. The red corpuscles now appear to coalesce. It is during this period of gradual retardation of the blood-stream, and whilst the vessels are dilated, that the liquor sanguinis exudes, and the white corpuscles, or leucocytes, migrate from the vessels,—a locomotive property possessed also by the red corpuscles under certain circumstances: and this transudation appears to be dependent on some change in the vital relations of the blood-vessels and their contents, as it does not occur in health. The accumulated leucocytes which have thus escaped from the vessels appear like a mass of protoplasm, and possess amœboid movements and the power of absorbing materials with which they are brought into contact: pus globules are derived chiefly from leucocytes, and their abundance may be accepted as a measure of the reparative effort in an inflamed part.

Lastly, it should be remarked that the liquor sanguinis differs from serum in containing fibrin: the former is essentially an inflammatory exudation, whereas the latter—serum—may be poured out under various circumstances which are

independent of inflammatory action, and as readily reabsorbed. Thus, redness and heat are due to the increased flow of blood to an inflamed part, and the more rapid evolution of caloric; the pain is due to tension, and the swelling to exudation.¹

The extremes of temperature produce similar effects upon the body. Severe burn and frost-bite destroy texture; and the reaction which succeeds reduced temperature is a condition closely allied to the immediate effects of heightened temperature. Vital action in a part may be suspended for a time by a low temperature, and restored if the suspension be not continued too long; permanent loss of vitality may ensue on the continuance of this low temperature, or it may be consequent on too sudden and excessive reaction. Excess of temperature, within certain limits, can be borne with impunity; but beyond those limits the skin becomes inflamed or vesicates, or both it and deeper textures may be rapidly destroyed. Free perspiration and rapid evaporation are very preservative of the skin in air of a high temperature.

In considering the therapeutic action of heat and cold it is necessary not only to regard the local condition, but also the general state or constitutional power of the patient and his reactionary vigour: it is also frequently expedient to consult his feelings as the best guide in the election between the two. As regards the local signs, we should have a definite object in view, based on a clear conception of the actual condition of the affected parts, and of the probable effect of the application, in which the important agency of the vaso-motor nerves plays a conspicuous part.

Lengthened exposure of the body to either a high or low temperature, whether of the atmosphere or in bathing, exercises a depressing influence on the frame generally: this is probably by a direct appeal to the nervous centres, and also by derangement of the blood-pressure. Heat favours activity in the circulation, especially of the surface of the body; but cold produces congestion of internal organs, and pallor of the surface and muscular rigidity, which is due to exclusion of blood from the capillaries of the skin and muscles, in consequence of the contracted state of the small arteries, under the

¹ This subject is treated more fully in the first section of my 'Outlines of Surgery,' 2nd edit.

influence of the vaso-motor nerves. Locally the effect is similar: warmth favours relaxation of the tissues, and exudation as well as cutaneous secretion are encouraged: cold stimulates contraction of the small arteries, and thus diminishes the quantity of blood in the affected area. In each case, therefore, relief is obtained in an inflamed part, though in a different way.

I am convinced that cold bathing is indulged in too indiscriminately, and without due regard to simple elementary conditions. Very few persons can, unless gradually habituated to it, remain long in cold water, in this climate, without risk. An active swimmer of course has the advantage of being in exercise, but even he should be cautious. The not infrequent instances of sudden death under these circumstances are generally attributed to cramp: it is far more probably due to arrested action of the heart, consequent on serious disturbance in the equilibrium of the circulation, produced by vascular constriction on the surface; and this may be accompanied by some degree of muscular rigidity, but not sufficient to paralyse an expert swimmer. Again, it is a popular belief that it is dangerous to enter the water when warm; whereas, it is the immersion of the already chilled body that does mischief. A brisk walk to the bath is a good preparation for it. This caution is exemplified by the impunity—the benefit indeed—with which a cold bath is taken immediately after exposure of the body to a high temperature in the hot-air bath. I was agreeably surprised, on my first experiment in this way, to find how much less the shock proved than I anticipated: yet it is not unreasonable it should be so, when we consider the condition of the circulation on the surface, constituting, with the activity of nerve-energy, a preparedness for the shock; the effect would be different if the immersion were protracted beyond a few seconds. Of course feeble reactionary power should be prohibitory of cold bathing: and the true therapeutic effect of this hygienic agent is obtained by the sudden and complete immersion of the body, and a speedy and thorough friction of the surface with a rough towel: for this is not only invigorating, but the skin is thereby thoroughly cleansed of its loose epithelial scales. I may remark, for the advantage of those who cannot bear cold bathing, that towel-

gloves, dipped in water, and used for rapid friction of the skin, followed of course by rough drying, are a good substitute.

I have naturally no experience of the value of cold affusion in fevers, but I can speak of the grateful and soothing effect of tepid sponging in surgical fever: in each instance the beneficial result must be directly due to the reduction of temperature.

Hot-water bathing is popular, more, I suspect, because it is agreeable than for its therapeutic advantages; and I am disposed to think that the same remark is applicable to most medicated baths: but this is a medical rather than a surgical subject. Long immersion in water much above the temperature of the body has certainly a depressing or enervating effect, and should not be indulged in, except for some special purpose. Of the Turkish or hot-air bath I entertain a high opinion, where it can be borne, and there are really few whom it does not suit. It is a safeguard against headache to wet the head before entering the hot-air chamber; for the evaporation obviates the distress occasioned by the heat until perspiration commences. Of vapour baths I have no experience.

“Packing,” according to the hydropathic system, is another mode of applying water to the surface, which can be classed with neither cold nor hot applications. It is true that the sheet or wrapper is cold when used, but the purpose in view is to procure copious perspiration, and this is more readily secured, in most cases, by the reaction succeeding the shock of the cold sheet. The fact is that “packing” is nothing more or less than a poultice, in the form of a water-dressing on a large scale. It acts generally in the same way as a poultice does locally, and is, certainly, often very efficient in restoring the equilibrium of a disturbed circulation, and in promoting, directly or indirectly, a healthier condition of the secretions. No doubt the cold sheet is best when it can be borne; but I do not regard this as an essential element in the treatment: tepid or warm water is to be preferred where the reactionary power is feeble and insufficient.

Various means may be employed for local reduction of temperature; but, in all, the *modus operandi* of the remedy is the same, viz. by vascular constriction and consequent

exclusion, more or less, of blood from the part to which the treatment is directed. This must be the reflex effect of an appeal to the vaso-motor centres. The relief thus obtained explains in great measure the amelioration of all the signs or symptoms of inflammation; for the diminution in the quantity of blood, contained in a given area, necessarily lessens proportionally the redness, and so much of the swelling and heat as is due to that cause; for the heightened temperature depends on the more active evolution of heat at the focus of inflammation, where the chemical changes correspond with the quantity of blood in the affected area. Pain is likewise mitigated by the reduction of the tension: but this depends on the stage of the inflammation, and on the resistance of the tissues affected.

The topical use of cold must be determined very much by the stage of inflammation. As a rule I have been accustomed to limit its employment to the early stage, *i.e.* before the tension of the tissues indicates that plastic exudation has already succeeded the stasis in the vessels. In deep-seated inflammation, especially under dense fibrous tissue, cold is rarely admissible. It is imprudent, in some cases dangerous, to use cold applications to an inflamed surface, where there is a risk of inducing a metastatic transfer of the inflammation to some other part; and this remark applies more particularly to certain specific forms of inflammation, and also where the surface of the chest or abdomen is involved. In traumatic hæmorrhage from small vessels cold is valuable by stimulating contraction of their open mouths: and it may be employed with advantage in arresting bleeding from the rectum. Where cold acts as a nerve-sedative it is probably by the intermediate agency of the blood-vessels, through the vaso-motor nerves.

Ice is now used largely in both surgical and medical cases. It is a prompt and efficient mode of employing cold; and is certainly valuable in many instances, where there is no mechanical difficulty in its use. But in the majority of cases I prefer trusting to the uniform and continuous action of an evaporating lotion, either of lead or spirit; it is a gentler and more soothing mode of accomplishing what is desired; but a thin strip of linen should be used, and this should never be

allowed to dry. Irrigation is an excellent mode of employing cold, whether to reduce temperature or to arrest bleeding. It is scarcely necessary to add that caution must be exercised in depressing the temperature of parts which have naturally a low vitality; and that any pathological condition which denotes local deficiency of power or waste or impending molecular disintegration forbids the employment of cold.

There is one use to which a rapid reduction of temperature was formerly applied, but which is almost entirely superseded by inhaled anæsthetics. The temporary freezing of the sensitive skin which was to be incised in operating was then considered a great boon in many operations: and I do not think we do well to discard it altogether now. This may be accomplished either by a mixture of pounded ice and salt, the action of which is very rapid and requires caution, or by a spray of ether. A deadly pallor overspreads the surface, and the skin is almost crisp as the knife passes through it. The cold caused by the above mixture is intense, and its application must not be prolonged.

The utility of the topical employment of *heat* is exemplified in various ways and conditions. I would first remark on the wasteful expenditure of this vital element of our existence by unnecessary exposure and insufficient clothing: and this especially in the case of the young, under the popular but absurd impression that they are thereby "hardened." I believe that much illness is produced and many lives are sacrificed by lack of due attention to the elementary truth, that food is taken for combustion and the evolution of animal heat, as well as for growth and the supply of material waste by nutrition. Of course there is an opposite extreme in which too much fuel is heaped on the fire: therefore our heat-supplying food should be adapted, in quantity and quality, according to the atmospheric temperature and our need.

For the local benefit to be derived from heat it should be allied with moisture. Indeed it is the combination of these two elementary conditions of vegetable growth that fulfil all the desiderata for which fomentation, poultices, and water-dressings are employed in surgery. The office for which these applications are used is, as already observed, that of relaxing

the tissues, and of favouring transudation from the vessels, and from the skin if unbroken. In a granulating surface warmth and moisture favour growth and reproductive energy; in molecular death the failing temperature is supplied artificially and the structural *débris* is removed. In acute suppuration the employment of moist heat is serviceable both mechanically and vitally; and in the early stage of inflammation, it is often very grateful to the patient as well as serviceable in relieving the tension of the vessels.

Where it is available, without too much disturbance of the patient, fomentation is the most efficient method of applying warmth and moisture: but it must be perseveringly used to be fully serviceable. Whether a sponge or a soft coarse flannel be employed, it should be placed in a basin and some hot water poured on it: then it should be thrown into the centre of a towel and rolled up: it can thus be wrung out by twisting the ends of the towel. If covered over with a dry flannel and piece of macintosh, it will retain the heat for a considerable time.

Poultices may be made of a variety of ingredients. Linseed meal sometimes irritates, perhaps because it is impure: in one instance recently under my notice, its use always produced constitutional disturbance and nettle-rash. The best bread poultice is made from stale bread, grated. Scraped carrot makes an excellent stimulating poultice; linseed with stale beer-grounds is similarly useful. A cleanly substitute for linseed or bread is the water-dressing, and therefore in many cases it is to be preferred. Some soft and absorbent material should be selected, such as lint, or, still better, "absorbent wool," which must be sufficiently wetted to ensure its retaining the moisture, under cover of oiled silk or gutta percha. In the treatment of open wounds with this dressing a weak antiseptic solution may often be used with advantage, wherewith to moisten the pad. The material known as spongio-piline is cleanly, but heat soon spoils it. As the object is to retain the heat and moisture generated in the skin rather than to supply them, it is of little importance whether the water-dressing be applied hot or cold, except for the comfort of the patient at the moment of application. Stimulating lotions are more beneficial when applied, as to an ulcer, on

lint beneath the poultice: to medicated poultices and fomentation I do not attach much value. As a derivative moist warmth commends itself alike to physicians and surgeons; and its agency in such case is due to its physiological influence over the vessels of the surface to which it is applied. With cleanliness as its handmaid, and functional rest, the surgeon requires little else in the treatment of many troublesome cases, where patience is of more avail than active, and therefore frequently mischievous, interference with Nature's method of cure.

ON NATURE'S METHODS OF CURE.

I have spoken elsewhere of the lesson we all have to learn of mistrusting our own independent ability to cure disease, and of the danger of disregarding or thwarting nature in the suggestive teachings which are presented for our observation and instruction in almost every pathological condition which we are called on to treat. It is almost impossible—so it seems to me—to exaggerate the importance of this study; it adds greatly to the interest of our professional duties if pursued in a philosophical spirit; whilst it inculcates humility, and establishes our self-reliance on a stable foundation, and is the best antidote to empirical practice. A few observations on nature's methods of healing will serve to indicate and exemplify the import of these remarks and to give expression to convictions which have no novelty to recommend them, and can lay claim to no authority except such as their maturity from lapse of time may confer.

Elimination.—Eliminative action plays an important part in the animal economy in disease as well as in health; for a large proportion of the pathological phenomena which we witness are simply the expression of nature's effort to eliminate that which is noxious from the system; that which, if retained, would interfere with the healthy discharge of function or threaten life itself. It is true that this eliminating activity, by its excess or in consequence of the direction in which it

works, may be an aggravation of the original mischief or in itself a source of danger : nevertheless it must be regarded as essentially salutary in its aim : and in an appreciative acceptance of this truth we have a guiding principle in our practice, which will stand us in good stead in many doubts and perplexities. It is well to work with nature, and to rely on her guidance and teaching ; and then she will welcome the aid we can supply in furtherance of her efforts, instead of resenting officious and ill-timed interference or opposition to her indications. This, indeed, is one of the chief lessons we may learn from the study of the subject now under consideration.

The organs which are chiefly engaged, physiologically, in eliminative action are the great excretory glands, with the cutaneous and mucous surfaces of the body. Provision is thus made for the carrying off the refuse of the ingesta, both solid and fluid ; and the products of the vital chemistry are also removed, in so far as they would be detrimental if retained. The carbon, which is the product of combustion, is eliminated by the lungs, those great thoracic glands, which are constantly pouring it forth in its gaseous solvent by the tracheal duct. Each organ has its own special function ; yet it is interesting to notice how harmoniously they co-operate, often helping one another by vicarious action. The skin and mucous membrane, the kidneys and liver exemplify this sympathy, in their effort to maintain that equilibrium of functional discharge which constitutes health ; an effort which is often thwarted or rendered nugatory by imprudence or wilful provocation, until the constantly overtaxed exertion of these organs terminates at length in premature disorganisation and death.

The compensating and recuperative power of our frame is manifested in the frequent functional derangement to which it is subjected, with only transient ill-effects : and it is this very impunity which so commonly misleads those who consciously expose themselves to the strain. But the longer the evil day is deferred, the more sudden and certain is the penalty exacted. This is the history of a multitude of diseases, in which even vicarious eliminative action at last fails to relieve ; and there is nothing then to fall back upon ; dissolution, under these circumstances, cannot be long deferred.

There are not many diseases the whole of which lies upon

the surface, so to speak: there is some hidden spring which if recognised and understood, explains that which is superficially observed. Yet this association between the visible and the unseen induces us not infrequently, and sometimes incorrectly, to attach more importance to the former than to the latter; to regard signs and symptoms as the disease itself, instead of searching more deeply for the latent cause of these external proofs of its presence. Naturally such false pathology is likely to betray us into erroneous treatment, if we deal with effects only and leave the cause untouched, perhaps unsought. No doubt the true seat of a disease—the *fons et origo mali*—may be quite inaccessible to us, as in specific fevers; then it is our business to wait on nature, supplying the needful support, and mitigating the severity of the measures she adopts for the elimination of the poison which is beyond our reach. In such cases we are restricted to the treatment of symptoms.

In surgery also the cause of patent mischief is itself frequently concealed from view; but is more often within the reach of remedial assistance than in medicine. The presence of deep-seated pus, or the occurrence of internal strangulation, and many forms of accidental injury are familiar examples. Diagnosis, in short, is the best test of a medical man's capacity to practise any branch of his profession: cultivated ability in this respect distinguishes the man of science from the empiric; and not less so the student of nature from the student of books.

But to return;—what part does elimination take in disease? It is one of nature's most potential instruments in its cure. Wherever it is practicable the demon is to be cast out; and in this very effort an important organ is sometimes taxed beyond endurance, and its structural integrity is imperilled or damaged; and the remedy is thus as dangerous as the disease. This is exemplified in the crisis or sequelæ of typhoid and scarlatina and many similar illnesses, in which the care of the physician is diverted from the primary source of the mischief to these grave complications, which are, unhappily, too often beyond his control. Extravasation of urine illustrates the same subject surgically. Death is inevitable if the urine cannot be expelled, and the bursting of the conduit behind the obstruction is the best natural effort to obtain relief. The

surgeon's early intervention may prevent this decisive step ; and even its disastrous consequences are accessible, and their fatal issue may be averted by timely aid.

On passing in review the various diseases to which the human frame is subject, how few there are in which elimination does not play a more or less conspicuous part, where a natural curative effort is established. As zymotic diseases are essentially blood poisons, the phenomena which characterise them are the accompaniment or expression of the effort to eliminate the poison. Whether the germ theory or presence of micro-organisms be the real explanation of these specific and communicable poisons or not, there can be no doubt that the blood ultimately distributes them throughout the system ; and it falls on certain selected organs, especially the skin and mucous membranes, to suffer the penalty of having to discharge them. That such is the case is sustained by the fact, that the gravest cases are those in which the local manifestations are mild ; and that the dose of poison is sometimes sufficient to destroy life, by its action on the nerve-centres, before any eliminative effort is made.

It is difficult to evade the conclusion that many cutaneous eruptions are eliminative. Their behaviour seems to indicate that such is the case ; for they appear and retreat with varying conditions of health ; and their presence is often associated with relief from some other ailment, as their suppression is the signal for its development.

In like manner many affections of the mucous membrane are eliminative. Diarrhœa rarely occurs in a healthy mucous membrane, unless for the removal of some source of irritation ; and for this reason it is far more judicious to accept nature's suggestion and to help her by an aperient, than to attempt to foil her efforts by astringents ; unless, indeed, the flux continue after the removal of its cause. The mischievous effects of repletion are often obviated by diarrhœa, or by timely hæmorrhage. I watched for many years the case of a large consumer of animal food, who was kept in tolerable health only by periodical attacks of diarrhœa, of a severity which would have prostrated most other persons.

Cholera must be viewed in the same light ; the poison, whatever it may be, appeals especially to the alimentary canal

for its removal. But here we have an illustration of the severity of the remedy proving so often fatal: therefore the eliminative treatment, though sound in principle, becomes more than questionable in practice: we must control instead of stimulating nature's energetic action, and endeavour to tide over the operation and more gradual expulsion of the poison. I should have more confidence in appealing for help to the skin by "packing" in hot wet sheets, hoping thereby to relieve the intestinal congestion.

Influenza, and even common catarrh, exemplify eliminative affections of the respiratory surface. Epidemic influenza seems to depend on certain atmospheric conditions, not necessarily associated with temperature; and the constitutional disturbance accompanying an attack is suggestive of some poison circulating in the system, of which the catarrhal flux is the elimination. The same sometimes may be said of ordinary catarrh, for I think there can be little doubt that exposure to vicissitudes of temperature or moisture of the atmosphere are not to be solely credited with all the severe colds that are caught. In some instances periodical fluxes from the respiratory mucous surface are evidently a relief to the system; and in a very considerable proportion no efficient reason can be assigned for these attacks. Possibly the presence, in excess, of ozone in the atmosphere may account for many of these respiratory affections. The attack is sometimes so sudden that it would seem as if the sufferer had passed through a current of poisoned air. I remember, many years since, experimenting on myself in a way that caused me much subsequent inconvenience. I was watching the operation of a machine for generating ozone, and had the curiosity, or rather foolish temerity, to breathe the product for a few seconds. The result was a very severe catarrh, which affected not only the nasal membrane, but the throat, eyes, and ears, and proved both prostrating and persistent. A bright sun with an east wind is generally prolific of catarrh, and this is an atmospheric condition favouring the evolution of ozone. No doubt irritation of a mucous membrane, by whatever means, may produce a copious and sustained secretion: but this cause operates very much as does a poison, by disturbance in the balance of the circulation, and is treated, if left to nature, in the same

way. The same is the case with serous and synovial membranes when subjected to similar disturbing influences; but this is a branch of the subject which will be considered more appropriately farther on.

The progressive softening and ulceration attending the later stages of tubercle must be regarded in the same light as eliminative. Thus tubercular gland abscess and caries of bone are naturally cured, and we are led to believe that tubercular phthisis, if localised, is similarly curable, even though abscess cavities in the lung exist.

The phenomena attending gout and rheumatism are similarly characterised. In both, especially the former, the attacks are, in many cases, irregularly periodical; the system becomes charged to overflowing with the poison, which must find some vent, by local expenditure; subsequent immunity for a season being the compensation for the suffering: yet many a distorted hand and foot bear lasting testimony to the activity and earnestness of the eliminative effort. Urinary calculus may be included in the same category: and here the surgeon's aid is required to complete that which nature has begun but cannot finish.

Secondary syphilis partakes of the same character, and if mercury and iodine are to be credited with all that is claimed for them in this stage of the disease, when nature is exerting herself to eliminate the poison, I presume we must attribute the beneficial result to the expulsive power of a new poison introduced into the system; which appears, indeed, to be the most rational explanation of the agency of mercury in the primary disease: one poison kills the other; under certain conditions they cannot co-exist.

I do not say that cancer is eliminative, but we have no conclusive proof that it is not so. It seems more than probable that there are two distinct agencies operating in the evolution of this disease: one, which is systemic, in the disposition or tendency to so-called cell-production; the other local, in which the attractive power of some special organ or tissue is exercised to determine its localisation: unless, indeed, we assume that this cell-growth is due *exclusively* to the reproductive property or proliferation of the localised cells, without the operation of any general or distinct influence. But this

cannot be established by observation; and there is much in the history of cancer which is opposed to this theory. If, then, the disease be not entirely local in its origin, it may express an effort nature is making to rid the system of something noxious, by the development and local deposition of a low form of cell-growth, which seems incapable of further evolution. But this is, of course, mere speculation.

Dyspeptic disturbances of various kinds manifest the eliminative disposition in their different phases. It is scarcely necessary to particularise these, which are both vital and chemical; and, though kindly meant, are productive of much discomfort to the sufferer. But it is very much his own fault if he fail to avail himself of the friendly suggestions, as to abstinence and regulation of diet, which this discipline is designed to inculcate.

Idiopathic erysipelas and carbuncles are likewise probably eliminative inflammations, occurring, as is generally the case, in a depraved condition of the system; and the expediency of endeavouring to suppress their development is, at the least, questionable, as we cannot have much confidence in the elimination of the poison by any other channel. If this suppression can be accomplished by treatment in anthrax, whatever may be the pathological explanation of its origin, the usual result is a renewal of the specific inflammation in the neighbourhood, in probably increased intensity and with aggravated suffering. The local treatment in each case should be palliative and soothing, and special attention should be directed to correcting any functional derangement, and to supplying, but with discretion, the needful support. In the surgical management of carbuncle nature's indications should not be anticipated, except in rare cases of extreme and protracted suffering from tension: the small ulcerated apertures may be enlarged to facilitate the discharge of sloughs; but large incisions are generally to be deprecated.

Pyæmia is essentially eliminative when time and opportunity are afforded. The poison, whatever it is, may be speedily fatal, as in some zymotic diseases; and, unhappily, pyæmia exemplifies the fatality of the eliminative effort, when some vital organ is selected as the seat of purulent deposit. A peculiarity of this dreaded disease is, that the mischief is usually

generated within the body and not introduced from without ; a circumstance which, as it indicates a disposition to initiate the evil, implies also a preparedness to amplify it by organic fermentation, and thus to defy anticipatory or present treatment. The most rapidly fatal cases, in my experience, have occurred most unexpectedly. It is prudent and safe to encourage any tendency to the localisation of purulent deposit, whenever it may manifest itself in a favorable locality. Occasionally we witness instances of purulent deposits transferred from, perhaps, some distant part, and unattended by the constitutional disturbance which characterises pyæmia. The rapid healing of such abscesses is a test of their eliminative nature ; for they are unaccompanied by destruction of tissue, or any but mechanical disintegration of the textures, usually superficial, in which they are formed.

Many animal poisons, such as have their source in dissecting wounds, are often eliminated by the arrest of the poison in the guardian lymphatic glands, which thus sacrifice themselves and suffer disorganisation for the general weal. Such an issue is to be desired ; for if the poisons pass these glands unchallenged, the result is often fatal from the general contamination of the system.

One further and striking illustration of this subject may be adduced ; it is that of organic inflammation, especially of the lungs, in certain pathological conditions of the body—it may be kidney mischief, or gout, or some allied disease—in which the inflammation occurs without any other assignable cause. This would seem to be the explanation of many cases of pneumonia and bronchitis. Some act of elimination is accomplished ; and if the patient recover, it is generally without leaving any permanent damage to the affected organ.

It is not improbable that some nervous affections are but the expression of an effort to obtain relief, which bears no fruit that we can recognise, unless it be that the battery is overcharged and thus disburdens itself.

The power of resisting infection, usually attributed to individual insusceptibility, is probably often due to early eliminative energy, before the poison has mingled with the circulation. This may explain the various effects in different persons exposed to the same infecting influence ; as it is by no means the

robust whose immunity is most marked. It is not so much a question of the dose of poison received, or perhaps even of its zymotic tendency in the recipient, as it is of its partial or complete elimination, before it manifests its presence by the usual external signs and constitutional disturbance. But we know very little of the explanation of these observed facts, and still less of the way in which immunity from a second attack is secured by the first infection, or how protection is afforded by inoculation with a milder poison of the same nature. The facts are of great practical value, and may be far more largely utilised than at present, even though the secret of their subtle agency remain unrevealed.

There are, of course, many morbid conditions which manifest no eliminative disposition : but they are, for the most part, such as appeal directly to the nerve-centres, and thus, as it were, paralyse the sources of organic and animal life. Of this class are tetanus and hydrophobia, and some other spasmodic diseases ; and the more deadly vegetable and mineral poisons. Also many new or hypertrophic growths and most atrophic affections ; organic disease resulting from impairment of function or the converse, are amongst those pathological conditions for the relief of which nature can exercise no eliminative effort, but must resort to other, if any, means of relief.

But these means are not expended, though elimination be unsuitable or impracticable ; and it will be interesting to examine and exemplify other natural measures employed in the cure of disease. Many of these may be conveniently classified under the following headings, and yet leave this prolific subject unexhausted. Increased or diminished functional activity ; reformation or new formation of tissue ; and partial removal by death.

Increased Functional Activity.—In increased functional activity we recognise another and comprehensive natural method of healing, especially in the repair of lesions, whether from disease or injury. The vaso-motor nerve-centres are in free telegraphic communication with the whole system, and issue the needful orders when the alarm of any disturbance is given. When the area of the lesion is limited in extent, the vascular activity is also localised ; but more serious mischief rouses more general activity, and thus creates constitutional

disturbance of more or less intensity. In some instances the shock of injury paralyses, for a time, the organic nerve-centres; and the recovery may be tardy, or the reaction may be excessive: in other cases there is no recovery, or the shock may be immediately fatal, as when a severe blow is received in the epigastrium or neck.

Augmented activity is manifested, physiologically, in many and various ways; as in hurried respiration or circulation during exercise; in stimulation of different secretions, notably that of the stomach during digestion; and wherever and whenever a claim is made for increased exertion, at the bidding of normal or abnormal incentives. Pathologically it is witnessed in the anastomotic expansion of the collateral circulation, after obliteration of a large arterial trunk; and in the various stages of the healing of a wound. One practical lesson, in relation to pathology, which a thoughtful consideration of these self-evident illustrations teaches us is not unimportant; viz. that functional activity, if abnormally and repeatedly excited tends to structural change, and thus often lays the foundation of organic disease.

Diminished or suspended Functional Activity—physiological rest—is also an important factor in the cure of disease or injury. The surgeon has special need to lay to heart the lessons taught by nature in this respect; for it is difficult to draw the line of distinction between functional and mechanical rest. Too little heed is paid, in some instances, to the natural craving for abstinence from work. How often, in sickness, is the stomach taxed to digest food which it loathes, and which it absolutely refuses to assimilate; and how frequently and unnecessarily is it irritated and worried with stimulants and nauseous drugs, when all that is asked for is rest, and time to recover functional energy. We are accustomed to ascribe much to augmented activity of the absorbents in the removal of abnormal or hypertrophic growths; whereas, in many instances, this result is attributable rather to suspended or abated activity of deposition. How important is the enfeebled action of the heart in arresting hæmorrhage; how essential the arrested function of the lacerated lung, in fractured rib, when air is pumped into the pleura until compression secures physiological rest. That periodical

repose is the normal rule finds an exemplification in every organic as well as animal function. We work by day and sleep by night, when brain and muscle alike rest; the digestive organs have their active duties and intervals of repose: and so even the untiring heart and lungs, between each beat and respiration: and the greater the exhaustion the longer the exemption from toil that is needed for recuperation. There are, doubtless, occasions when this exhaustion is perilous, and the enfeebled organic life requires stimulation: but the watchful practitioner can rarely mistake the fruitless effort, for the craving demand for rest. The critical prostration must be tided over, or the waning power sustained by suitable stimulants or nutriment, until the normal function is restored.

Re-formation or new formation of tissue is needed wherever a lesion is accompanied with loss of texture. It is interesting to notice that such reproduction is not necessarily identical with the original tissue which has been severed or destroyed, but that it usually answers the same purpose functionally. I say usually, because the elastic and other properties of the skin and its subcutaneous connexions are never perfectly restored after loss of texture.

It has been remarked that the lower the organisation the more perfect the reproduction: I should be disposed to say rather, the more important the texture which demands renewal the more perfect that renewal. Such appears to be the case with two important structures, bone and nerve; and the reproduction of blood-vessels is a remarkable illustration of the same principle. In the case of muscle, fibrous union does not interfere with its utility: and in severed tendon a long time is required for actual reproduction of identical tissue and continuity of fibre, though this is ultimately accomplished. As regards nerve, the renewal of function, which of course implies reunion of tissue, is very remarkable, as each severed fibril must, it would seem, resume its continuity; or there must exist some unexplained manner in which the functional readjustment is arranged without such continuity: and recent evidence has been supplied that, even after a long interval, the original function of a divided nerve may be perfectly restored, by freshening and adapting its severed and perhaps widely separated ends. In union of a broken bone

new material is copiously or sparingly deposited, according to the requirements of the case; but all redundancy is subsequently removed, when consolidation is complete. The plastic wall which is built around an abscess, during its formation, is a temporary arrangement for the protection of surrounding tissues. The deposit of clot in the interior of an aneurismal sac is a natural curative tendency, which is occasionally effective. The curved shafts of rickety long bones are fortified in the concavity of their curves by osseous deposit. These are familiar examples of this branch of our subject. Physiologically, uniformity in growth is an essential condition of health; any deviation in excess or deficiency of textural ingredient is inconsistent with perfect health.

But nature also kills to cure. *Partial sacrifice by death* or some gentler means is a frequent and necessary step in the preservation of life in the mass. Molecular death is, indeed, inseparable from our existence. It accompanies us through life, is an essential condition of health, and never fails till functional activity ceases, and the laws of inorganic life resume their sway. But molecular death occurs in other and more palpable ways than in this physiological form, as exemplified in ulceration. And this is often an essential precursor of renewed health, being rendered so by previous injury or disorganisation of the tissues or parts to be cast off. The gradual separation of dead from living structures is an example of molecular death accompanied by repair. The natural cure of a strangulated knuckle of intestine is attained by the same process; and we imitate nature in strangulating tumours or *nævi*, with perfect confidence in her ability and will to cast off the noxious part and repair the breach. In like manner, when the vitality of a limb can no longer be sustained, whether from senile vascular deterioration or other causes, a natural amputation is performed. Absorbent activity is illustrated by the rapid removal of fluid from serous or synovial sacs; and the solid products of morbid action are also withdrawn by the same agency, in addition to their being starved of their supply. The influence of *pressure* in promoting absorption, and possibly also in reducing supply, is exemplified in many natural operations, such as the thinning of the walls of an abscess, the penetration of bone by pus or an aneurism and here

again we have been taught a valuable lesson in the mechanical command of vital action—a control which we cannot afford to ignore, and which might be utilised more largely, if more thoroughly recognised and carefully studied.

Compensation for natural defect, or for mutilation from disease or injury, is as frequent as is practicable; for, of course there are many cases in which there are insuperable physiological or mechanical obstacles, which preclude the possibility of any such arrangement. This principle is illustrated in the hypertrophic growth of muscle to overcome obstruction, as in the muscular coat of the bladder in enlarged prostate or permanent stricture; or in the thickening of the ventricle in valvular disease of the heart. Other tissues also become hypertrophied to resist pressure, as the ureters when subjected to long-continued distension. Pressure or friction also produces thickening for protection, as in the cuticle of the hands and feet. The osseous deposit in the concavity of rickety long bones exemplifies the same principle; as do the remarkable spinal tortuosities often noticed in deformities of the pelvis and vertebræ, so as to preserve, as far as may be, the perpendicularity of the column as a whole. Though some of these compensatory developments can scarcely be regarded as sanitary in their effect, they must, nevertheless, be considered such in design.

In anatomy and physiology, and indeed throughout the animal kingdom generally, we meet with compensations at every turn: and these are truly such, in effect as well as in design. But it must be borne in mind that nature does not work miracles; all must be conducted in accordance with her own laws, and in strict subservience to them. Not only are animals endowed in relation to their different acquirements, but certain inherent defects have their compensation in other special developments; the feeble being thus protected from the overbearing tyranny of the strong, and enabled to find means of subsistence when surrounded by foes. Swiftmess of foot, keenness of sight or scent, resemblance in colour or form to surrounding habitats, agility in climbing, are a few of these special attributes which contribute to the security of their owners, or to their facility in obtaining their food.

In anatomy the construction of the spine is a wonderful

exemplification of the compensatory principle, in vanquishing mechanical obstacles which seem insurmountable, and in combining functions which would appear irreconcilable. A column is required which shall have strength, resisting power against external violence, competency to support a heavy superincumbent weight, and qualified as a lever for strong muscles to sway in various directions, being withal flexible and elastic; and which, moreover, has to be entrusted with the guardianship of a vital organ that traverses its whole extent. The immunity from injury of this column is a measure of the perfection of a piece of mechanism which is capable of fulfilling these varied offices; sources of weakness which necessarily accompany the perfecting of one function being supplemented, without clashing or interference, by specially adapted complementary arrangements.

A less complex but still striking illustration of compensatory development is presented in the mechanism of the shoulder-joint. Freedom of movement is an imperative necessity, and not less so is security from displacement. The former desideratum is realised by combining a very shallow and limited articular cavity with an expanded hemispherical convexity on the head of the humerus; and these surfaces are surrounded by a fibrous capsule of such laxity as to be of little if any avail, except such as is due to atmospheric pressure, in preventing dislocation. Moreover, this joint, so framed as to be subject to the least possible restraint, is moved by powerful muscles, acting on a lever at a considerable distance from the fulcrum; for such are the deltoid, great pectoral and latissimus dorsi muscles. But these arrangements, though admirably calculated to favour unlimited mobility, so seriously compromise the safety of the joint, that, without some compensatory provision, it would be liable to dislocation at every movement. We find such provision chiefly in the mode in which the capsular muscles are clustered around the articulation, in the strength and resistance of their fibrous insertion, and in the circumstance of their fleshy texture being parallel to that of the larger muscles, synchronously with which they act; and whereby they neutralise the tendency of the more powerful muscles to produce dislocation, by holding the articular surfaces in contact. The position of the long tendon of

the biceps is a further security : but there is another factor of great value, and that is the mobility of the scapula, which follows the humerus in all its more extended movements, and thus continually presents its shallow cup to the head of the long bone.

The presence of inter-articular cartilages and ligaments in joints, especially in the knee, exemplify the same principle. And the augmented muscularity of the arteries, as they recede from the heart, is a striking instance of compensation ;—the waning influence of the central pump demanding some equivalent to sustain the circulation, where elasticity would be no longer available. And this physiological fact may be followed into many pathological sequences, of vast importance to the medical practitioner.

It is unnecessary to multiply these few and merely suggestive illustrations ; indeed, it may be asked why such truisms have been thus strung together. I can only reply by the expression of a hope that, here and there, a reader may be induced to look at the subject of this paper with more thoughtful interest than heretofore, and to have more confidence in nature's resources ; and, I may add, to be more willing to accept her teachings and to profit by them.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

(Continued from 'St. Thomas's Hospital Reports,' N.S., Vol. XVI, p. 31.)

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Cases illustrative of injuries of the astragalus.—Imperforate anus.—The treatment of stricture by caustic.—Strangulated hernia.—Disease of brain.—Wounds by ball and shot.

IN the present paper I propose to narrate the history of a few cases which illustrate points of practical interest treated of in my former papers, or which, from their infrequency, seem to merit a record in the accessible form of "Hospital Reports." Possibly some of our readers may be induced to supply similar cases, and thus aid in realising the design of these communications, by adding to the store of materials for the collective study of disease.

Injuries involving the Astragalus are often troublesome and perplexing. In its normal position this bone is wedged in between others, and so firmly tied to them by ligaments, that it is a marvel how it can be dislodged, though the difficulty of replacing it is sufficiently obvious. Attempts to classify these injuries are neither very successful nor productive of much practical advantage. I will narrate a few cases from my hospi-

tal notes, which will serve to illustrate the variety of these lesions, the way in which they happened, and their obstinate resistance to the attempts made to restore the displaced bones to their natural position.

1. J. S—, æt. 30, was carrying a hod of mortar up a ladder, and fell, when at a height of fifteen feet, on to his right foot. There was a large, horizontal wound over the outer malleolar region, from which protruded the tibia and fibula,—both unbroken and tightly grasped by the lacerated skin—together with the greater part of the astragalus, which was retained in its relations to them by its ligamentous connexions. The head of the astragalus and a small piece of its outer malleolar articulation were left *in situ*. The body of the astragalus was separated from the bones of the leg and removed; after which the tibia and fibula were, with some difficulty, replaced in their normal position. The leg was placed resting on the back, with an inside splint. There was some reactionary hæmorrhage, which was easily controlled. Subsequently an abscess formed in the calf, and the treatment was protracted. Ultimately the patient, who was a gin and beer drinker, recovered, and left the hospital of his own accord. When last seen he was still using crutches.

2. W. G—, æt. 36, slipped from a cart-wheel on which he was standing, and his left foot was jammed between two stones, and twisted at the same time. The astragalus was dislocated, and resting, with its head facing outwards, on the cuboid. It was thus wrenched from its connexions with the tibia, fibula and os calcis. By manipulation the head of the bone was restored to its navicular cup, but no effort could replace the body of the bone. All the surrounding bones were in their normal position; and the body of the astragalus appeared to be tilted forwards and outwards, so that the fibular articulation could be distinctly felt, and the skin was stretched over the most prominent angle of the bone. The malleoli were uninjured. The limb was kept at rest on a splint. On the third day, after considerable general disturbance, with rapid pulse and irritable stomach, the simple became converted into a compound dislocation by gangrene of the skin covering the bone. The opening was extended by incision and the astragalus removed; a small portion still attached to the os calcis being left. It was found

that the bone was more twisted in its abnormal position than was supposed. Subsequently phlegmonous inflammation extended up the leg and thigh, requiring free incisions. He rallied for a time, but ultimately succumbed about three weeks after his admission into the hospital.

3. R. A—, æt. 35, a florid, healthy man, was thrown from his cab, but cannot give any account of how he fell. He had a wound over the outer malleolar region, through which it was ascertained that he had a comminuted fracture of the astragalus ; but, singular to say, the fibula, as well as the other neighbouring bones, had escaped fracture. The outer fragment of the astragalus, including the greater part of the external malleolar articulation, was removed ; but the remainder of the bone, though ascertained to be broken, it was thought more judicious to leave in its firmly attached relations. This proved a very tedious case, suppuration continuing from the wound for two months ; after which, unfortunately, I have no notes of the case ; probably because he left the hospital before he was well. But my last memorandum induces me to believe that the patient ultimately recovered a serviceable limb.

4. Mr. J. G—, a bookbinder, æt. 51, of muscular frame, was stepping from an omnibus, when his right foot slipped, his left being on the bottom step : the consequence was that the former came violently to the ground in an inverted position. He attempted to walk but soon fell, observing that he trod on the outside of the foot, though at first he felt no pain. When the boot was cut away the following appearances presented themselves. The foot was inverted, so that the sole looked inwards, the deformity in this respect resembling talipes varus : the tendo Achillis was tense ; the astragalus was driven obliquely forwards, so that one third of its tibial surface was exposed ; the outer malleolar articulation was entirely dislocated, but the inner retained its position. On the upper part of the tarsus the skin was stretched tightly over a hard, rounded prominence, which was the disarticulated head of the astragalus. No fracture of either tibia or fibula could be detected. Extension without chloroform proving unavailing, he was put under the influence of the anæsthetic. I then grasped the foot firmly by the tarsus and heel, in the way in which a boot-maker would draw off a tight boot ; and extending and everting the ankle-

joint at the same time, the tibial dislocation was first reduced. The heel being then still drawn down with the right hand, pressure with the left on the back of the tarsus soon accomplished the further reduction of the head of the astragalus. The limb was then confined in a back-splint, with a foot-piece. There was subsequently a good deal of effusion at and above the joint, otherwise the patient made a good recovery, without the legacy of any lameness.

5. W. R. B—, æt. 28, a hotel-keeper, was driving a dog-cart to the Epsom races, when his horse took fright, and he was thrown out with violence, and dragged for some distance by the reins: his foot became entangled, as a policeman described, in the iron step of the vehicle. When seen by me he was in great pain in the right or injured foot. At first sight the deformity was not very marked; there was neither eversion nor inversion of the foot, nor elongation or shortening of the tarsus; the tendo Achillis was not tense; but the interval between the inner malleolus and tuberosity of the os calcis was occupied by a hard prominence over which the skin was stretched, and which proved to be the astragalus. There was very little surrounding effusion, therefore the outline of the bone could be easily traced. The tibial surface of the astragalus was superficial, looking inwards and a little upwards: the sharp margins of this surface and the malleolar articulations beyond could be distinctly felt. The posterior extremity of the bone was directed downwards and a little forwards; and the finger could trace the tibial surface, or trochlea of the bone, as far as the depression between it and the head. This, the neck of the astragalus, was driven behind the inner malleolus, and therefore its head or navicular portion must have been lodged behind and internal to this prominence, and beneath the base of the tibia. The dislocated bone was thus wrenched from all its connexions, rotated on its axis, and thrown inwards; so that its anterior part was directed upwards and backwards, and its upper surface faced inwards. I have been thus particular in describing the position of the dislocated bone, because I believe it is a unique example of this exact form of displacement, and because I had the opportunity of watching the case for many years after the occurrence of the accident.

The skin over the astragalus was tense; the circulation

through the posterior tibial artery was stopped, and the foot was numbed; for both vessels and nerves were stretched over the convexity of the displaced bone. After fruitless attempts at reduction under chloroform and with pulleys, the limb was placed at rest on an outside splint. It is unnecessary to follow the details of this case further than to say, that the tense skin retained its vitality, the swelling gradually subsided, the circulation and sensibility of the foot slowly returned, and the patient was ultimately enabled to walk with freedom. There was a certain amount of movement in the new joint, and the limb was, of course, shortened; yet he did not even require the assistance of a stick. The bearing of the foot was more on the outer side than natural.

The following case, involving the astragalus, derives a special interest from its exemplifying a very rare form of dislocation of the foot.

6. M. A. F—, æt. 23, was carrying a basket of clothes, when she slipped and fell, with her right foot twisted under her. She was in great pain, and the foot was inverted, presenting, at first sight, the appearance of an ordinary case of talipes varus: for it was rotated so that its dorsal surface was directed forwards, with an inclination downwards. On closer inspection the axis of the tibia and fibula were found to be natural: the tendons around the joint, especially those of the tibialis anticus and extensors of the toes, and the tendo Achillis were very tense. On directing attention to the ankle-joint it was apparent that fully half of the articular surface of the astragalus was in front and to the outer side of the articulation, as a finger could be laid in a depression behind the anterior and external angle of the quadrangular surface of the astragalus. The foot was thus thrown forwards and rotated inwards, with its plantar surface backwards, and fixed in that position; the heel was shortened. Reduction was accomplished by still further extending the foot and twisting it outwards: when brought into a straight line with the tibia the foot was restored to its normal position with a perceptible shock; and all deformity, muscular tension and pain at once ceased. There was no fracture; and, singular to say, there was no tangible or visible evidence of ruptured lateral ligaments; though it is difficult to imagine that such a displacement could exist without such lesion.

From a review of the foregoing cases it would appear that the injury is caused by the foot being twisted, whilst the astragalus is at the same time forcibly compressed between the tibia and os calcis; the shock combining with violent distortion to produce either fracture or dislocation of the astragalus. The weight of the body and length of leverage act to great advantage under these circumstances. The difficulty of determining the exact position of a dislocated astragalus is often much greater than would be supposed; and especially so when effusion has masked the actual relation of parts. In estimating the possible consequences of a compound dislocation or fracture of the astragalus we must not lose sight of the many bones involved in this injury, and of the large articular surface which is subjected to violence and exposure:—circumstances which go far to explain the severity of the consequent local and constitutional symptoms in most cases. This accident belongs to a category of injuries which are often fatal to the habitually intemperate. The same risk is, of course, incurred, where the simple dislocation or fracture becomes, by sloughing, converted into a compound one. It is remarkable how rarely the bones of the leg or their malleoli suffer in these injuries. In those cases which I have on record of dislocation of the foot backwards one or both malleoli were fractured, or the fibula gave way higher up. The retention of vitality by the astragalus, when isolated from its normal connexions, is also worthy of observation. In Case No. 4 only was there any serious opposition offered by the great extensor of the foot; and I was prepared to divide the tendo Achillis had it been necessary. There is a partial resemblance between the lesions in Cases 4 and 6, inasmuch as there was a dislocation of the foot forwards in each case; but in the former this was complicated with displacement of the astragalus.

As regards rules of practice in this class of cases it would be unsafe to speak dogmatically, or otherwise than generally. My own experience disposes me to regard much and continued violence in the effort to reduce a dislocated astragalus as fraught with considerable risk. Case No. 5 demonstrates how great is the capacity of the parts concerned to adapt themselves to their new relations, and how useful a foot may be obtained where the astragalus remains displaced. In reference to this

case, the hotel-keeper, I may remark that I had no fear for the vitality of the foot, in consequence of the arrested circulation through the posterior tibial artery : the communication between it and the anterior tibial in the foot was a security against that contingency. But I did dread ulceration of the tense skin, which would have exposed the tibial vessels and nerves, and thus have added a fresh complication to the existing mischief. The subsequent restoration of sensation and circulation is interesting. It is, I think, rarely admissible—I have not known a case—to interfere by operation where the displacement is simple, unless it be with a view to the removal of the bone, or for the division of an obstructing tendon. In compound dislocation or fracture the surgeon must be guided by the condition of the bone as to isolation or comminution, and as to its reducibility : but in general it will be found that the removal of the bone simplifies the case, offers the prospect of a better recovery, and eventually secures a more serviceable foot. In simple irreducible dislocation it is judicious not to meddle, but to trust to nature.¹

Imperforate anus is not a very rare congenital defect ; and the form in which it presents itself is usually simple and easily remedied. In some instances, however, such is not the case, and considerable responsibility is thrown on the surgeon in dealing with them. I will narrate a few typical cases, one of which I referred to in a previous paper, and which derives its special interest from the length of time it has been under my notice.

1. I was requested to see the infant son of a lady who had been confined on the previous day, as it had just been discovered that there was no outlet from the rectum. The child was evidently beginning to suffer from the obstruction. There was a small depression where the anus should be, but no aperture. On pressing the abdomen, or when the child cried, a soft fluctuating bulging could be distinctly felt at this spot. I passed a small scalpel rather more than half an inch through the depres-

¹ Since writing the above my attention has been directed to Sir W. Mac Cormac's paper on "Sub-astragaloid Dislocation" in the third volume of the new series of the 'Reports,' to which, therefore, the present communication may be regarded as supplementary.

sion, when meconium began to exude; and I then dilated the opening sufficiently to introduce a sponge tent, after the bowels were relieved. This was withdrawn, periodically, for three days, after which a bougie was introduced daily till the wound was healed. The child made a satisfactory recovery.

The foregoing case illustrates the simplest form of this congenital defect: the following case exemplifies a more rare and troublesome form to deal with.

2. M. C—, æt. five months, was a hospital patient. The imperforate anus was accompanied by a fistulous communication between the rectum and vagina, by which of course the fæces were passed. The course adopted in this case was to establish an anus in the first instance; and this was readily accomplished by passing a probe from the vagina through the fistulous aperture to the spot where the outlet should be, and then cutting down upon it. The new opening was kept patent by the use of bougies until it was healed. The further treatment by closing the fistula was deferred for a time, and I have no memorandum of its completion. Possibly it may have contracted so as to occasion little inconvenience; and thus the parents may have been induced to withhold the child.

3. A female infant, about four days old, was brought to the hospital in a dying state, with a distended belly. The anus was imperforate, and ineffectual attempts had been made to open a communication with the bowel. By penetrating deeply with a scalpel, directing its point towards the left iliac fossa, I succeeded in reaching the rectum, and meconium flowed abundantly: but it was too late; the child died within twenty-four hours. The post-mortem examination was made by Dr. Hicks, who supplied me with his notes. The various organs were healthy. The large intestine was much distended with gas and some feculent matter. The rectum terminated in a *cul-de-sac* just behind the os uteri. In this there was an incised opening about an inch in length, which communicated, through a passage in the cellular tissue behind the vagina, with the anus, which last appeared to be normally developed, and to have extended upwards for more than an inch. The uterus, vagina and bladder presented a normal development. There

was no trace of peritonitis. The cause of death was functional disturbance and exhaustion. That an earlier effectual operation would, in all probability, have saved life is demonstrated by the following case, to which I referred briefly in a short notice on this subject in an earlier communication.

4. W. W— is a private patient, on whom I operated thirty-six years since, and who is now the father of a family. He was a well-developed child, and born forty-four hours before I saw him. A small *cul-de-sac* existed, in the position of the anus, a full half inch in depth, and sufficiently capacious to admit the point of the little finger. The child was beginning to suffer considerably, and rejected everything taken into the stomach. Not the slightest impulse was communicated to the finger when the child cried or the abdomen was pressed. Having explained to the parents the attendant risks and probability of failure, I proceeded to operate. I passed my finger into the *cul-de-sac*, and along it a straight, narrow and pointed bistoury, which I directed upwards and backwards for more than an inch. Some venous blood but no meconium followed. I then passed a director, and felt a slight impulse against it when the child cried. Thus encouraged I passed the bistoury along the director for another half or three quarters of an inch, guiding it toward the left iliac fossa, and anticipating, possibly, a gush of arterial blood; but on withdrawing both knife and director there was an abundant discharge from the bowel and very little blood. The child speedily rallied, and went on well for a week, the bowels acting freely. At the end of this time I was informed that the artificial opening did not yield to dilatation and was nearly closed: consequently I was requested to see the child again. The obstruction was at the deepest point, where the artificial canal communicated with the intestine, the circumference of the aperture being firm and callous. I divided this obstructing ring backwards and on either side, and afterwards introduced and expanded a pair of dressing forceps, so as to dilate the opening and relieve the bowels. In the course of a month considerable progress had been made, but there was constant tendency to contraction and obstinate constipation, unless the dilatation was employed most diligently.

It is unnecessary to register the further details of this case, the treatment of which extended over many years. It was not

until a later period, when manual assistance was frequently required, that I ascertained, with tolerable certainty, the exact condition of the rectum. Originally it appeared to have terminated in a sacculated extremity, which had, no doubt, become expanded by frequent distension. Even with the watchful care of a mother crises could not be warded off; and my assistance was repeatedly required to unload the *cul-de-sac*, distended with hardened masses of fæces, an operation which exacted both patience and care. I found that the handle of an ordinary dessert- or table-spoon was the best instrument to employ in breaking up these fæcal concretions; and I accomplished it gradually by alternating this mechanical assistance with the free use of water by injection. Aperients and enemata in the intervals between these periods simply deferred the evil day; and I apprehend the explanation to be, that the sacculated bowel had little power of diminishing its own calibre, and thus contracting on its contents. The entrance into this sac was so high up in the artificial passage, as to preclude the exploration of its interior with the finger. The most troublesome time, because the most neglected, was the interval between childhood and manhood. Even now carelessness or neglect entails similar suffering: and it was only last year that, circumstances rendering neglect in the habitual use of enemata and aperients, and in regularity of habits almost compulsory, my patient had a serious illness due to this life-long trouble. This patient is now thirty-seven years old; and, with the above exception, enjoys good general health.

These cases speak for themselves. Where the rectum cannot be reached, there is, of course, the alternative of opening the colon; a resource so repulsive in an infant as to justify the risk of a deep plunge with the knife, before despairing to establish a communication with the bowel in its normal position. The external sphincter seems to be perfectly developed in these cases.

Stricture.—In an earlier contribution to the 'Reports,' I have advocated the treatment of *stricture* by the use of potassa fusa, on the value of which experience has taught me to rely. I venture now to exemplify this subject by transcribing from my hospital note-books two cases which occurred within a few weeks of

each other ; because they serve to illustrate the class to which this treatment is appropriate.

1. H. M—, æt. 40, was a coachman and a spirit-drinker. He had gonorrhœa fourteen years before, but had suffered from stricture for only four years, during which time he had retention of urine on two or three occasions. After several futile attempts to pass an instrument, a No. 1 straight catheter was introduced, the urethra bleeding freely. Subsequent trials were unsuccessful, though always accompanied by hæmorrhage. It was evident, both from the history of a permanently diminished stream and difficulty in expelling the urine, and the existing obstruction, that there was an unyielding permanent stricture, of the irritable kind ; *i. e.* accompanied by a tendency to spasm and bleeding. After a fortnight's rest and general treatment, potassa fusa was applied to the stricture. Directions were then given to pass, from time to time, a No. 8 sound down to the stricture, and to keep it pressed against the obstruction, without any effort to pass it. At the expiration of another fortnight the caustic was again applied ; and on the following day a No. 8 metallic instrument was passed into the bladder. Three or four days later a No. 10 was passed without difficulty ; and micturition was free and painless. Before leaving the hospital he was taught to pass an instrument for himself. When seen three or four months afterwards a full-sized instrument could be passed, and the patient continued quite well.

2. W. P—, æt. 36, a blacksmith, had suffered from long-continued gonorrhœa and gleet, which was arrested, about three months previous to his admission into the hospital, by the use of injections : stricture succeeded ; probably the consequence of the protracted disease, though I am not disposed always to absolve the remedy in these cases. The seat of the obstruction was about two inches anterior to the bulb ; and the urethra was congested and irritable, bleeding freely when any attempts were made to introduce an instrument. Micturition was difficult and the stream was small. When the patient had been an inmate for ten days potassa fusa was applied to the stricture. This occasioned pain and some bleeding. The operation was repeated at intervals on three or four occasions, after which a No. 8 catheter was passed into the bladder.

The urethra continued to bleed, for a short time on each introduction of the instrument ; but ultimately a full-sized catheter was passed without pain or hæmorrhage, and the patient left the hospital quite well.

In recommending this treatment I wish it to be understood that I do not undervalue, by comparison, other immediate methods of relieving stricture. Indeed I have no right to do so, as I acknowledge that I have no experience in either splitting or cutting a stricture. These methods did not commend themselves to me, because I was satisfied with the use of the caustic where I could not deal with a case by the slower plan of gradual dilatation ; and because laceration or section, besides the attendant risks of these operations, seemed to involve the probability of cicatricial re-contraction of the canal. Whether these apprehensions are well-founded I do not know from personal observation. Patient perseverance will generally do much in most cases, without operation. In organic stricture—for of such only am I speaking—the obstruction is, in almost every instance, due to a thickening, originally inflammatory, of the submucous areolar tissue. The primary object, therefore, is to get rid of this adventitious deposit ; and pressure helps very materially in slowly accomplishing this desideratum. A short and nearly straight sound, passed down to, and firmly pressed against, a resisting stricture for some minutes daily, will aid in procuring absorption as exemplified in the first case. I have often employed this supplementary help in the slow treatment of impermeable stricture where there was no particular urgency.

The character of stricture to which this treatment is best adapted is that in which there is rigid resistance, with a sensitive, irritable condition of the urethra, the relief of the latter condition accompanying or even preceding that of the former. The cure in these cases I have found to be complete and permanent ; and I have never, in my own practice, experienced any serious consequences from the use of the caustic. Of course, this mode of treating stricture may, like other operations, have mischievous results. Appropriate cases should be selected, and the patient's health should be attended to ; and careful supervision must be exercised during the treatment. Micturition should precede the operation, and the patient should be kept

quiet afterwards. As regards the ultimate result I venture to affirm that, for permanency of cure, the caustic potash treatment will bear comparison with any other form of immediate treatment. If a full-sized instrument be passed from time to time, there is as much security against recurrence of the disease as can be reasonably expected under any circumstances.

The instrument I used was constructed for the purpose, and is described in my short comment on stricture in an earlier paper. I may here repeat that it is a No. 8 sound, of which half an inch at the extremity unscrews. This fragment is perforated, and the caustic is placed, with a little lard, on the end of the long male screw which fits into it. The sound is then passed quickly down to the stricture and kept pressed against it; and as the caustic deliquesces it exudes through the central aperture, and is thus applied directly to the seat of obstruction, where it should be kept for a minute or two. It is of course requisite to secure a free passage for a large instrument down to the seat of stricture, before employing the caustic in the way described.

Mr. Wagstaffe, lately our assistant surgeon, informs me that he adopted this plan of treatment, in consequence of witnessing the success in my cases; and that he can speak in similar terms of high commendation of it, from the results in all the cases in which he so operated. He recommends the initiatory injection of sweet oil into the urethra, to guard its surface from injury.

Hernia.—1. The following case has nothing remarkable in it beyond its typical representative character, which I think makes it worth recording. Three years since I was asked by Dr. Alliot to see with him a patient in the Sevenoaks Cottage Hospital. This patient, a young man of twenty, had a painful swelling on one side of the scrotum, about the size of a small pullet's egg. This swelling extended up the course of the cord to the abdominal ring, and was tense; and its whole surface was inflamed and very tender. He said that the swelling began a day or two previously at the lower part of the scrotum, after riding on a bicycle; and that he had suffered in a similar way on a former occasion, the attack subsiding spontaneously. He had no pain in the abdomen or across the umbilical region.

The confined bowels were not relieved by a dose of castor-oil, and he vomited after taking food, and had attacks of hiccup. The pulse was about 100 ; tongue furred but moist.

I recommended that an injection should be given ; and, if relief of the symptoms were not obtained, that an exploratory operation for hernia should be performed. I will give the remainder of the case in Dr. Alliot's words. "After the enema, which brought away a hard, lumpy stool, the symptoms—sickness and hiccup—abated ; and I began to think the patient's condition would improve permanently without operation. On the following day, however, sickness and hiccup returned accompanied with pain, and I decided to operate. After making an incision in the upper part of the swelling and dissecting down through the tissues, some fluid was evacuated, with the result that the swelling of the scrotum subsided, and the testis could be plainly felt. I found the cord greatly thickened and tightly nipped at the external ring, but no intestine could be detected. After enlarging the original incision and slitting up part of the tissues over the cord, I was enabled to pass my finger along the inguinal canal and through the internal ring, the surface being smooth and apparently the interior of a hernial sac. When my colleague also made this examination, on withdrawing his finger a piece of intestine followed it, of a claret colour, evidently a part which had been strangulated in the canal. This was carefully returned and the wound was closed." After the operation the symptoms subsided, and the patient made a good recovery.

The practical interest of this case consists in its exemplifying a class which is not very uncommon in hernia, viz. such as present symptoms of a character to suggest a doubt as to the necessity or propriety of operating. But beyond this, in the present instance, the special question presented itself as to whether we had to deal with a hernia at all, or had only a case of acute orchitis to treat. As favouring orchitis the following circumstances may be mentioned. The patient asserted that the swelling began at the lower part of the scrotum ; it was very tender and of a bright crimson colour. There was no pain in the abdomen or across the umbilicus, and the local tenderness and inflamed surface were such as would appertain to an inflamed testicle. The bowels, moreover, acted in response to

the enema. On the other hand, there were circumstances suggestive of hernia. The swelling and tension extended as high as the cord could be traced, and had not the circumscribed hardness usual in inflamed testicle. The bowels were confined and no action followed the administration of the oil. Food was vomited, and hiccup recurred at intervals. The patient's statement that the swelling was induced by riding on a bicycle, and that he had previously suffered from a similar attack which subsided spontaneously, might account either for the presence of a rupture or of an inflamed testicle, though these symptoms seemed rather to favour the supposition that there was orchitis. The pulse, temperature and tongue might have belonged to either.

The practical deductions are these : 1. Not to place too much reliance on a patient's statement, or on any one particular sign or symptom ; for, if the swelling began at the lower part of the scrotum, this was not consistent with the history of a hernial protrusion. 2. Not to be influenced by the action of an injection, which may empty the lower bowel, whilst the small intestine is strangulated. I regarded the non-action of the castor-oil as far more significant. 3. Not to trust too much to the character of the pain or the appearance of the surface of a tumour, which, in this case, certainly resembled those of orchitis rather than of hernia. Lastly, in all doubtful cases of this nature to operate. Such an exploratory examination, if not needed, could do the patient but little, if any, harm ; but if required and not undertaken, the neglect would probably sacrifice his life.

The explanation of the case I believe to be this. The inguinal canal and rings were sufficiently capacious just to allow of the descent of a hernia ; on a previous occasion such descent had caused him suffering for a time, and the intestine had then returned spontaneously. Further, that the rupture was congenital, the tunica vaginalis being the sac, the fluid within which was retained there, in consequence of the communication with the abdominal cavity being obstructed by the strangulated intestine. The strangulation was not so firm as to require the use of the knife ; indeed the history of the operation seems to point to the supposition that the intestine was partly or wholly withdrawn, when the tension was taken off

the sac by the evacuation of the fluid it contained ; but its condition proved there had been strangulation, and that the operation was thereby fully justified. I may remark that, in my experience, congenital herniæ, when strangulated, generally demand the earliest possible relief: the symptoms are urgent, unless, as was probably the case in this instance, the canal has been dilated by the occasional descent and return of a rupture.

2. The following is also a typical case, though presenting itself in rather a rare form. J. B—, æt. 63, a blacksmith, was admitted with symptoms of acute strangulation of bowel. On the previous day he had been suddenly attacked by a “twisting” pain in the centre of the abdomen, and soon afterwards vomited, when he took some brandy and water. The hernia was femoral, and the symptoms were so urgent, that I at once operated. My dresser remarks, in the notes with which he supplied me, that the operation was protracted for the following reason. The sac, which was opened (as was my custom), was found to contain only omentum, the condition of which was such as to satisfy me that the explanation of the urgent symptoms must be sought for further. Therefore I proceeded in carefully examining by dissection the neighbouring parts; there was no intestine concealed by the omentum, but I found a distinct sac, of much greater thickness than that which contained the omentum, and which on being opened was found to be empty. The crural ring had been previously divided and the omentum returned. The symptoms were relieved by the operation, and the patient made a good recovery.

I say this case is typical, because it belongs to an insidious class which, in my observation, is not infrequent, viz.: an intestinal protrusion superadded to a pre-existing one of omentum. Symptoms of acute strangulation, when omentum is found in the sac, and especially in cases of pre-existing rupture, are suggestive of this form of hernia. A careful scrutiny of the contents of the sac is therefore demanded. But in this instance there was the further and rare complication of a double hernial sac. The condition of the patient, antecedent to the attack which brought him to the hospital, can be only matter of conjecture. I have no memorandum of a previous rupture, but the small and hidden sac was, from its density, probably

an old descent, which was a source of no inconvenience until the omentum descended, pushing before it a separate covering of peritoneum, and thus blocking the common aperture. Division of the stricture had, no doubt, relieved the strangulated intestine and allowed of its spontaneous return. It is to be remembered that we were dealing with a femoral hernia, and that each rupture was small.

3. Though small intestine and omentum are the usual contents of hernial sacs, occasionally other organs occupy this abnormal position. I have met with one case of this unusual character. C. B—, æt. 76, had been the subject of a double rupture for twenty years, both being inguinal. He was admitted with strangulation on the right side. The tumour was tense and tender, but there was no sickness. On opening the sac I found its contents were the cæcum, with its vermiform appendix, which were partially adherent, so as to render their separation and return unadvisable. He was relieved by the operation; the bowels acted, and there was neither abdominal pain nor sickness after the strangulation was relieved. But he never rallied, and died on the ninth day, with a brown tongue and low muttering delirium. At the post-mortem it was found that the neighbouring tissues were infiltrated with pus; and that the mucous membrane of the large intestine as high as the transverse colon was dark and congested; the middle of the ileum presented a large ulcer, partly cicatrised.

From what I have said it will be gathered that the absence of hernial contents within a sac, even where the evidence of strangulation is very decided, is not an extremely rare occurrence. It has happened to myself and I have seen it happen to others. But, although this condition may be explained in the way I have described, or be due to the taxis without perceptible decrease in the size of the tumour, it behoves the surgeon to be mindful of the possible alternative of internal strangulation in explanation of the symptoms.

Although I cannot recall any instance in which I was so unfortunate as to wound the intestine with the knife, I have seen and had under my care several cases of artificial anus, associated with hernia. This occurred in an old lady of ninety-one, on whom I operated, and who, notwithstanding this drawback, survived for three weeks, and manifested considerable

power of local repair. In two similar cases I employed pressure, with a light truss, on the oblique passage or channel of communication with the bowel; and in both it was effectual. One of these cases was a neglected femoral rupture in a female: it became strangulated and had been left to nature. The bowel sloughed, and an abscess had opened up a communication with the interior of the intestine. This inference I drew from the intelligent history given to me by the patient. The abscess was open when I first visited her, and the contents of the bowel were readily identified in the form of fruit seed, &c. Nature is rarely so kind as in this instance. One case I was requested to see, in consultation, very many years since, in which a ventral hernia had been opened, by mistaking it for an abscess. It is a happy circumstance that injured intestine is so disposed to rest. Probably the lesion paralyses the muscular activity. However that may be we nearly always find a portion of strangulated bowel close to the aperture through which it was restored to the abdomen; and speedy advantage is taken of this period of repose, where an artificial opening exists, to glue it to the neighbouring parietes, so as to prevent extravasation of the intestinal contents. This is a lesson of non-interference by purgatives at an early period after operation. Probably more fatal cases occur from this abuse of medicine before surgical interference, than from any one other cause: incontrollable diarrhœa after operation may destroy the patient's chance of recovery.

One embarrassing case is worth mentioning from its unusual nature. A young man was the subject of a diffused swelling over the lower part of the abdomen, which, from its form, position, and other local signs, suggested the existence of a parietal abscess; but the history and general symptoms left no doubt in my mind that there was a strangulated hernia. Being consulted, I advised immediate operation, which was performed with the result of exposing a portion of protruded bowel spread out beneath the aponeurosis of the external oblique muscle. It was a large inguinal hernia, the sudden descent of which appeared to explain this peculiarity. In a similar case which came under my notice a diffuse parietal abscess really existed; but it proved to be in communication with the bowel.

The variety in the details of hernia operations is inter-

minable. I have rarely operated without learning something : but this is a form of personal experience which it is impossible to impart, save by laying down some general rules, and narrating some of the deviations from the ordinary types that are met with in everyday practice. To secure success I should give special prominence to two rules : operate early, and give the intestine rest to recover its tone. In my experience, delay, rough handling and purgatives are the chief causes of fatality in hernia operations.

The following isolated cases are, I think, sufficiently interesting to merit a record in our 'Reports.'

In 1884, Mr. Don, of Sevenoaks, asked me to see J. V—, a railway servant, who was under his care. He was a young man of thirty, of reserved and placid temperament, average intelligence and sober habits. He had been married seven months, and his wife was pregnant. His general health had been good till he began to suffer, within a few weeks, from hemicranial pain, affecting the right side, which had latterly become severe. This I learned afterwards ; the immediate cause of my seeing him being recurring attacks of priapism, which lasted for several hours. The first time this occurred was at the beginning of March : a fortnight later he had a similar attack ; and on the 20th, after severe hemicranial suffering, he had a third attack, which lasted, with scarcely any even partial intermission, until I saw him on April 1st.

The corpora cavernosa only were affected ; the bulb, corpus spongiosum and glans being undistended. He complained of pain in the perineum and lower part of the back ; and movement of or pressure on the tense penis increased his suffering. Aperients, and camphor with henbane had been given without relief. I ordered leeches to the perineum and a cold hip-bath, which afforded some ease to the pain in the back, perineum and penis, but the priapism continued without abatement. On April 6th an elastic catheter was passed, as he complained of difficulty in micturition ; it was on this day I first heard of the paroxysms of headache.

On April 9th the local condition was unchanged, the priapism continuing without intermission. His general condition was then alarming, and left no doubt as to the source of the

local distress. He was delirious and deaf: his pupils were somewhat dilated and acted sluggishly but uniformly. He complained of headache, and was at times violent and intractable, though his countenance was placid. He had a fair pulse of 96; his skin was moist; tongue a little brown in the centre; temperature 99°.

On April 11th he was constantly delirious and sleepless, his condition resembling very much that of drunken delirium; his temperature, pulse, &c., remaining unchanged. One sixth of a grain of morphia was injected subcutaneously, which procured several hours' sleep at intervals. On the 12th he had two epileptic fits; one of short duration, the other lasting a quarter of an hour. He was still constantly talking incoherently, and the priapism continued, with little variation and no intermission. During the following night he slept, the morphia injection being continued; and on the 13th he was fairly rational, wandering only at times; the epileptic fit was repeated, but of short duration: he was entirely deaf. The general condition continued unaltered in other respects. On the 16th he was sensible and free from pain. He had two or three epileptic fits each day. The subcutaneous injection of morphia was continued daily. The report on the 19th is that he was quite rational, and his general condition was improved. The priapism continued, and he complained of much pain on the right side of the penis, and also of pain in the legs.

After this report the patient improved gradually. His pulse fell, and the fits were rare, feeble and transient,—little more than a passing sensation. He could just hear a very loud noise, but complained of being unable to distinguish colours. He was wasted and weak, and slept badly. No pain in the head. The priapism gradually subsided, leaving merely a congested state of the penis. He micturated freely; indeed, he had done so without assistance since the catheter was once passed. The morphia was discontinued. His pulse, tongue and appetite were good; and his temperature had never risen above the normal standard. There was no priapism after the 20th, but he then still continued deaf to any conversation, however loud. His pupils were sluggish, and his incapacity to distinguish colours continued. He said the green fields looked brown;

and any attempt to read distressed him, as the letters "seemed to get out of place."

I did not see this patient again for a month ; until May 20th. He was then able to get about, but his hearing was very little improved, and his sight continued very defective ; he could not see anything clearly. He was free from delusions, and had no more fits, but was often giddy and deficient in co-ordinating power, occasionally falling. On examining his abdomen a considerable swelling was found to occupy the left hypochondrium, which was diagnosed as a large spleen. Subsequently to this date I did not see the patient ; but I am informed that there was nothing particular to remark concerning him, except that he had occasional fits of excitement ; that he gradually wasted in body and became feebler in mind ; and had an attack of acute iritis a few days before his death, which occurred on October 9th, about six months after the first attack. He died comatose. When Mr. Don informed me of his patient's death he sent me an account of the autopsy, which I give in his words. "The spleen was about four times the normal size, and much harder than natural. The liver was also considerably enlarged. There was much congestion at the base of the brain, and more fluid than usual in the ventricles ; but I found nothing else, though I searched carefully for any morbid appearance."

I regret that this case is incomplete, in consequence of the necessary absence of that minute examination of the brain, which might have yielded to the histologist some further information regarding the actual seat of morbid change. The case is, however, interesting from the rarity of the prolonged and uninterrupted priapism, which was considerably in excess of anything I have ever seen ; lasting without intermission, for an entire month. There can be no doubt that this condition had a cerebro-spinal origin ; and the exclusion of the spongy portion of the penis seems to indicate that the muscles commanding the corpora cavernosa were alone affected by the spasm to which I am disposed to attribute their distention. The only alternative explanation is that of supposing the vaso-motor nerves at fault, which does not seem to me probable. The hemicranial pain, the delirium, deafness and defective vision, with the epilepsy and imperfect co-ordinating power, all point

to the cerebro-spinal centre as the seat of disease; whilst the partial recovery and subsequent history of the patient are suggestive of some acute cerebral affection, subsiding into a chronic form, and involving progressive pathological degeneration which proved fatal. I do not venture to speculate upon what may have been the association, if any, between the nervous affection and the hypertrophy of the spleen and liver.

In 1885 I attended the following case in company with Dr. Alliott of Sevenoaks.

Mr. W. W—, æt. 36, of spare frame, healthy and temperate, was shot from behind with a revolver by a man who was walking with him. The conical bullet penetrated the left scapula below its spine, passing directly through the chest, and making its exit at the second intercostal space about three quarters of an inch from the left edge of the sternum; it also pierced his under-clothing, and lodged inside his waistcoat. He said he felt a smart blow but no pain. Knowing he was shot he ran to his home, which was about 200 yards distant. When I saw him with Dr. Alliott, shortly after the injury, he was in a state of collapse, with feeble and rapid pulse. There was some blood on his linen, both in front and behind; and small fragments of bone, apparently of the scapula, were removed from the anterior wound. The external hæmorrhage, which was slight, had ceased. A light dressing was applied to the wound, and perfect rest was enjoined. This was on May 1st.

On the following day there was some reaction and bloody expectoration, but the pulse continued small, feeble and quick; otherwise he seemed to be going on well. On the third morning he was suddenly seized with deadly faintness, from which he was restored by stimulants: and this recurred on the morning of the fourth day, and he slowly rallied under the same treatment, though his life seemed, as Dr. Alliott remarked, to hang by a thread. Champagne, and ether with brandy were the stimulants employed. The upper part of the left side of the chest was abnormally resonant; the lower part was dull on percussion. Bronchial breathing alone could be heard. Limited hæmoptysis continued for a week or ten days, after which the sputa became clear; and he had no pain and but little cough afterwards. He slept at intervals, and sometimes

for several hours. It was evident, in short, that the wounded lung was making satisfactory progress.

On May 12th, the twelfth day, the breathing became quicker and more laboured, and the chest on the left side was dull throughout; the heart being pushed over to the right side. Pulse 104 and feeble. The temperature had varied but little from the normal standard.

On the 14th Dr. Bristowe visited him; and acquiesced in the propriety of paracentesis: I therefore tapped the chest rather low down, between the seventh and eighth ribs, using the aspirator. About eight or ten ounces of fluid blood, of dark colour, were withdrawn; and as much oozed away afterwards in the dressing. More blood would have flowed at the time of the operation, but Dr. Bristowe thought it more judicious to withdraw it gradually.

On the 16th he was decidedly relieved in his breathing and had slept better. The heart still pulsated on the right side. Pulse 96 and weak. Respiration about 20 in the minute. The left side of the chest measured half an inch larger than the right.

On the 19th he was tapped again at the same spot, and about ten ounces of similar fluid were drawn off, with relief to his breathing. He subsequently passed a good night. The heart was more central, and the left side of the chest had diminished in circumference; but the resonance and lung sounds were unaltered.

On the 23rd he was tapped again a little higher up, with a syphon apparatus and a long tube depending in a basin of water. The object of this arrangement in preference to the aspirator was, that the fluid blood might drain away gradually as the chest contracted. Although great precaution was taken it was afterwards discovered that there was a slight imperfection in one of the junctions of the instrument, which permitted air to enter the pleura. About six ounces of fluid blood were withdrawn; but the instrument was not retained for the reason assigned. He passed two good nights; and, after eating imprudently, he was sick, vomiting some bile. On the 26th his temperature rose to 102° . On the 28th he was stronger and more cheerful, and took light food; the temperature was rather lower. He complained of no uneasiness, but his pulse was 120,

and his respiration 22 in the minute. His motions were devoid of bile and clay-coloured. The physical signs in the chest were unaltered.

On the 30th his condition continued much the same; the front of the left chest was tympanitic; feeble respiration was audible over the lower and back part. The impulse of the heart was felt to the right of the median line: the measurement of the two sides of the chest corresponded. During the next two days the condition of the chest remained the same; but he was feebler, and his pulse was rapid and irregular; the respiration being from 25 to 30 in a minute; and there were occasional sweats, but there was no rigor. He was, in fact, manifesting signs of blood-poisoning.

On June 1st I drew off, with the aspirator, eight ounces of stinking fluid like coffee-grounds mixed with blood, and much foetid gas: more would not flow. Some Condyl's fluid, diluted, was injected. On the following day fourteen ounces more of similar fluid were drawn off by the aspirator, but his symptoms continued unabated.

On June 3rd his condition seemed very critical; and a deep blush of inflammation had spread over the left side, from the scapula to the loins; puffy and œdematous. We felt that some more decisive step must be taken in order to save life; and I passed in a full-sized trocar and cannula, and drew off, with the aid of Dieulafois' admirable pump, fifty-two ounces of foetid fluid, similar to the last, and washed out the chest with a solution of Condyl. In the evening thirty-two ounces more were withdrawn through the same cannula, and the pleura was washed out with carbolic acid solution, one part in two hundred, about six ounces being left in.

On the following day, June 4th, his general condition was improved. Temperature 98°, pulse 108. Thirty-two ounces more of similar fluid were drawn off during the day, less foul and paler in character, though still containing a large proportion of blood. He had occasional perspirations, but no rigor.

It is unnecessary to pursue the daily details of this case further. The patient continued in a critical condition for some time, having an alarming fainting fit, varying temperature, hurried pulse and respiration, and a general condition which

continually excited anxiety. A long india-rubber tube was retained in the pleura, carefully protected by its open end being kept constantly in a vessel of antiseptic fluid by the bedside. The pleura was washed out two or three times daily during the month of June, the fœtor of the contained fluid and gas continuing. Usually two or three ounces of the antiseptic fluid were left in the chest. The heart was gradually coming over to its normal position. About the middle of the month a large mass of slough separated from the wound, where the cannula was inserted; and the rib was found to be denuded of periosteum. At this time some of the pleural fluid was examined by Professor Stewart, who reported that it contained a large number of micrococci singly and in chains, some bacteria, and cells, probably white blood-corpuscles. The discharge from the pleura was at this time quite purulent, amounting probably to three or four ounces daily. The wound being disposed to close, was occasionally dilated with a sponge-tent or enlarged with a bistoury. The depth of the opening was about one inch before entering the chest. An attempt to leave off the tube at the beginning of July was succeeded by an accumulation of pus and by general disturbance. On July 22nd a free external opening was made, and the exposed rib was felt. His temperature frequently rose to 100° or 101° , without any assignable cause. At the beginning of August he went to Hastings; but it was not until the end of the month that the tube was finally removed, after which the wound gradually closed, without any perceptible exfoliation of rib.

On November 1st our patient reported himself as feeling well. He looked so, and had regained his former weight. He said he could walk uphill without difficulty in his breathing; that he felt equal to any ordinary exertion, but that any extra demand on his endurance tried him a little.

This satisfactory termination of an anxious case was, no doubt, due in great measure to the youth and health of the patient, and the pure air in which he lived. Good nursing also helped importantly. As regards the nature of the injury I think there cannot be much difference of opinion. That the lung was pierced there can be no doubt; and almost as little, I apprehend, that a parietal artery of considerable size, most probably the internal mammary, was wounded: hence the early

collapse, and, after reaction, the subsequent fits of syncope which almost proved fatal. The physical signs in the chest confirmed this view which we took of the case from the beginning; and the subsequent tapping placed it beyond question. Fortunately there was no searching for bullet or fragments of bone and clothing, which were expelled at the time the injury was received. If there had been no hæmorrhage into the pleura, probably convalescence would have speedily ensued; for the hæmoptysis and local pneumonia quickly subsided; and if air had escaped into the pleura it would have been absorbed. The intrapleural hæmorrhage constituted the gravity of the case; and this was enhanced by the decomposition of the blood.

It may be a question whether the gas within the pleura was the cause or consequence of decomposition; or, again, whether air was not, from the beginning, mixed with the blood, by escaping, as it must have done, from the lacerated lung; and this tendency to decomposition was perpetuated long after it was impossible for air to be admitted. But the coincidence, as regards time, of the symptoms of toxæmia with the ascertained leak in the syphon seems to offer a more probable explanation; especially as the blood first drawn off by the aspirator—at an early period it is true—was not foetid. The rapidly developed and spreading blush of inflammation and œdema over the back was an interesting index of the state of things within. I regarded it as a clear and urgent solicitation for relief, and the initiatory step towards spontaneously obtaining it. I accepted the suggestion and acted on it promptly to the immediate relief of the urgent symptoms, and the withdrawal of the inflammatory warning. Intervals were allowed, in the drainage of the fluid, to allow the lung to expand and the chest to resume its normal contractility; until the urgency of the symptoms demanded free and speedy evacuation of the pleura. Though a portion of one rib was exposed for a considerable time, there was no perceptible exfoliation from it. I may remark that I kept a record of the quantity of fluid drawn off, and find that, after deducting the quantity injected on each occasion, it amounted to 176 ounces, in the aggregate.

P.S.—Since writing the above I have examined this patient's chest. The two sides are uniform, and the resonance through-

out is natural. Vesicular respiration is equally clear on both sides in front; but on the wounded side it is less distinct behind than on the sound side; for which difference a thickened pleura may probably account. The two sides rise and fall uniformly on deep inspiration. The only inconvenience he occasionally experiences is at the spot where the drainage-tube was so long kept in; but this, he says, is unimportant. He is not otherwise conscious of any deterioration in physical strength or endurance.

A remarkable instance of recovery after severe joint injury was recently under my notice. It probably has its parallel in the annals of military surgery; but it has not fallen to my lot to witness such complete destruction of a large joint by violence, without loss of a limb or a fatal result.

G. J—, æt. 36, of usually sober habits and good health, had unfortunately exceeded the bounds of moderation with some boon companions, when a gun, charged with shot, exploded close to him, and the entire charge entered the fore part of his right thigh, a little below Poupart's ligament and to the outer side of the femoral artery. He was admitted into the Seven-oaks Cottage Hospital, under the care of Mr. Worship, who requested me to see the patient with him. We found a large aperture in front, where the charge entered, and a large fluctuating swelling occupying the corresponding glutæal region. The man was suffering from the shock and loss of blood.

After consultation it was decided to make a free incision into the tumid buttock, by which a large accumulation of blood, in clots and fluid, as well as of shot, clothing, and many big fragments of bone were removed. An opportunity was thus afforded for free drainage, and the completely shattered condition of the joint was placed beyond question. There was no reactionary or secondary hæmorrhage of any importance.

For a long period this case was in a critical condition, demanding constant and careful supervision and nursing. Inflammation, of a phlegmonous character, extended down the thigh and leg; and abscess after abscess was laid open by Mr. Worship. Upwards of 200 shot were removed at different times, together with fragments of bone and pieces of clothing.

From an inspection of all these fragments, which have been carefully preserved, it is evident that the force of the explosion had been expended on the joint, which was completely shattered. Large pieces of the head of the femur, as well as of its neck and of the acetabulum can be readily identified. The charge must have passed at no great distance from the femoral vessels, and must have been within a little of entering the pelvis through the thin floor of the acetabulum. The bleeding was most likely derived from the glutæal and ischiatic arteries.

The patient's condition at the present time, after the lapse of a year and a half, is the following. The injured limb is about six inches shorter than the sound one. The nates have the appearance presented by a dorsal dislocation of the hip. The limb is occasionally œdematous and disfigured by purpurous blotches. A few shot have recently been discharged from a small sinus behind. There appears to be some movement between the upper extremity of the femur and the ilium: but it is limited; and it is difficult to judge of, on account of the movement of the pelvis. The patient's health is good; and he is able to walk fairly well, with the help of a stick and a high boot. I should add that Mr. Worship informs me there was a persistent tendency to eversion of the limb, which, by the diligent use of sand-bags and splints, he successfully combated, to the great present gain of the patient in walking.

Of many cases of gunshot wounds which I have had to treat, I recall one which is almost as remarkable as the foregoing in the escape of the patient. Many years since a young man was admitted into the old hospital, on Good Friday. He was out on a shooting excursion, and in climbing a bank or crossing a hedge, he drew his gun after him, with the muzzle towards his body. It exploded, and the entire charge was lodged in his epigastrium. His condition seemed hopeless; but, by careful examination, I could not detect any communication with the interior of the abdomen, though I concluded some such must exist, and that probably some viscus had been wounded. I afterwards ascertained that all the parietal tissues, except the peritoneum had been torn through; and the charge, together with a quantity of clothing, was lodged in actual contact with the exterior of this membrane. The case was tedious, in con-

sequence of the long-continued suppuration ; but the patient ultimately recovered. The deficiency in the epigastric wall necessitated the wearing of a broad, flat shield, truss-like, to afford the necessary support. After an interval of, probably, twelve or fifteen years, this man addressed me at a railway station, reminding me who he was. In reply to my inquiry he told me he felt no inconvenience from his accident, and had thrown aside his truss. Time had, in this respect, accomplished more than I anticipated, though probably less than justified the neglect of this precaution.

SOME PRACTICAL REMARKS ON THE JOINTS;

CHIEFLY IN REFERENCE TO THE FUNCTIONAL
RELATION OF THE MUSCLES TO THEM.

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THE form and fascicular arrangement of muscles is determined either by the function required of them, or by convenience. A simple as well as useful classification of muscles is that which accords with their function; and this in great measure decides their morphological development. Thus, we have muscles designed to move soft parts, as those of the scalp and the platysma, and those belonging to the lips and tongue, whose fibres are expanded and parallel or fan-shaped. Others enclose cavities, their use being to compress or contract the included spaces; and in this class there is great diversity of form, the fasciculi being usually laminated, and so arranged as most conveniently to exercise an uniform compressing influence. Thus, the heart has a spiral arrangement of fibre, as best adapted for rhythmic action; the stomach and bladder present examples of diverse layers of muscular fasciculi, traversing the surface of the enclosed cavities in various intersecting directions. The intestines again present a disposition of longitudinal and annular fibres, by the combined or alternate

contraction of which their vermicular movement is accomplished. The abdominal muscles, in the varied direction of their different layers, exemplify an arrangement which has for its purpose, primarily, the uniform compression of the abdomen.

But the largest number of muscles is comprised in the class which move the various levers of the limbs and the trunk. The fascicular arrangement of these is determined in great measure by convenience, especially in the neighbourhood of joints; otherwise they are composed chiefly of parallel bundles of fibre, which, in their aggregate bulk, usually diminish as they approach their destined insertion into the most movable part of their attachments.

In studying the action of these, as indeed of most muscles, it is insufficient to note what they are able to accomplish individually; it is requisite, for a full appreciation of their power, to examine them collectively, and particularly in their relation to those which are their opponents. In this way muscles which, under some conditions and circumstances, are found to act antagonistically, may be shown to possess a combined power in producing certain results, which are not at first sight evident, but which are even more important than the functions they perform individually. This remark, though exemplified in various ways, is especially interesting in the relations, physiological and surgical, as well as anatomical, of the muscles which are in close proximity to joints.

The succeeding observations are intended to illustrate more especially the following axioms. 1. Muscles constitute a protection to joints against injury. 2. Under favouring circumstances they contribute to the production of dislocation. 3. They are important agents in retaining a dislocated bone in its abnormal position. 4. They aid the surgeon in reducing a dislocation, when he knows how to avail himself of their assistance.

The *Shoulder-joint* presents the most obvious exemplification of these axioms, because its varied and complex requirements demand mechanical adaptations to reconcile contending claims; and because the muscles play so important a part in providing the requisite security against displacement, which is imperiled, not only by the configuration of the joint, but by their action.

An intelligent examination of the scapulo-humeral articulation, stripped of its soft parts and with its singularly contrasted surfaces displayed, is suggestive of the conclusion, that it is a joint admirably calculated to allow of the greatest range and freedom of movement, whilst its protection against displacement has been entirely ignored and neglected: and it would greatly perplex any mechanist to supply this defect, and also to endow the humeral lever with great motive power without interference with its requisite range of movement. It would almost seem, so to speak, as if this joint had been primarily constructed with a view, exclusively, to the single requirement of extended mobility, and that the ingenuity of the constructor had been subsequently devoted to correcting the radical defects, inherent in a plan in which every other consideration had been recklessly sacrificed to this one desideratum. How is this achieved?

The first consideration of the artificer (to carry on the figurative description) would be to give a covering or capsule to the joint: and he is at once met by the difficulty of supplying one which would afford any useful protection without impairing freedom of movement. This sacrifice must not be entertained; therefore we find a thin and lax capsule which really subserves no further purpose than that of presenting a closed sac, and an extended surface over which an expanded synovial membrane is spread. Even the next stage in the construction is adverse to the integrity of the joint; for, with extended movement great power is a necessary attribute of the arm; and in order to realise this requirement large muscles are attached to the humeral lever at a considerable distance from the fulcrum:—an arrangement which, whilst it adds vastly to the power of the muscles, very materially enhances the risk of dislocation during their action. Such are the deltoid, great pectoral and latissimus dorsi muscles, with the teres major, by which the most extended and vigorous movements of the arm are achieved.

The limit of sacrifice to one all-important desideratum has now been reached, and the consideration of protection against displacement forces itself, so to speak, on the notice of the artificer; and a notable step in this direction is taken by the introduction of a somewhat complicated arrangement, whereby the socket is enabled to follow the ball in its wider range of

motion. For this purpose a pivot is formed at the sternoclavicular articulation, on which the scapula and clavicle are conjointly moved by muscles appropriated to that office, thus constituting a shifting fulcrum, suggestive of a parallel disposition with that of the sliding seat now adopted in rowing; at the same time that those movements are controlled and limited by other muscles, as well as by ligaments. The trapezius, rhomboidei, levator anguli scapulæ, pectoralis minor, sternomastoid, subclavius, biceps, coraco-brachialis, are all more or less directly engaged in these actions. Then the capsule has to be strengthened, without interfering with freedom of movement; and herein is specially manifested the admirable mechanism which is to compensate for so much that has been sacrificed to the one primary requirement. The insertion of the capsular muscles is as near as practicable to the fulcrum, and their strong, expanded tendons are more or less identified with the capsule. They, in this way, invest the joint except at its lower part: but the added strength is not only a passive but also an active resistance to violence threatening to produce dislocation. This is exemplified negatively when these muscles are paralysed, and the elongated capsule permits of separation between the adjoining surfaces of the articulation, as a consequence of the feebly supported weight of the arm. But this tonic action is not all, nor is it, indeed, the most important function of these muscles, which consists in the simultaneous action of each with the parallel fibres of the larger muscles which move the lever. In this way each capsular muscle has its special office, which is that of acting synchronously with its big associate in the varied movements of the humerus, and of thus counteracting the tendency to displacement, consequent on the distance of the chief moving power from the fulcrum; and they probably all act together, when the need occurs, in keeping in close contact the articular surfaces. Their office, as rotators, is quite subsidiary to this far more important function. The long tendon of the biceps, in its fixed position, constitutes not only a passive protection to the upper part of the joint, but it helps to steady the head of the humerus; and, in conjunction with its coracoid origin and coraco-brachialis, it acts in concert with the rotator muscles, in holding the head of the humerus in contact with the glenoid cavity. It is needless to add that

the fibro-osseous roof of the joint and projecting coracoid process afford protection from external injury, but only to a limited extent against the risk of displacement.

The natural inference to be drawn from this review of the shoulder-joint is that which we know practically to be the case; viz.: that its dislocation is caused chiefly by muscular action. Indeed, so commonly is this the case, that I cannot recall an instance, within my own experience, of this injury to the healthy joint, which could be attributed exclusively to direct violence. A fall on the palm or elbow, when the arm is extended and the articular head of the humerus is, consequently, about two thirds below the glenoid cavity, is almost invariably the explanation of this injury,—the active agents being the deltoid, pectoralis major, latissimus dorsi and teres major. It cannot be denied that, by force applied even in this direction, fracture instead of dislocation might be produced by muscular action: but, if the head of the humerus resist displacement, there are two feebler points which give way before the shaft of the bone, viz.: the clavicle and the base of the radius; either of which may be broken by a shock communicated from the prone hand when the arm is extended. Almost as invariably fracture of the neck of the humerus is due to direct violence, because the position of the arm, except when extended, is unfavorable for dislocation; and the joint is protected in the directions in which shock is likely to operate, *i.e.* above, before and behind. The violent contact of the humeral head with the glenoid cavity is the actual cause of fracture of the long bone near the joint, or of a similar, though in my experience extremely rare, injury to the glenoid cavity or neck of the scapula. The interference of these capsular muscles with the treatment of fracture of the neck of the humerus is, practically, unimportant. The tilting of the upper fragment by their conjoint action, when the fracture is below the tubercles, is readily controlled, in most cases, by a suitable shoulder-splint.

Thus the integrity of this joint is due, in great measure; to the active protection afforded by the articular muscles; and further, it may be affirmed, with equal truth, that, under favouring conditions, muscular action is the direct cause of dislocation; and almost always, primarily, in the direction in which least resistance is offered by the capsular muscles. It is

superfluous to add that muscular resistance is the chief obstacle to reduction of the displaced bone, or that the efforts of the surgeon should be directed to overcome this resistance, and to place the head of the bone in such a position in relation to its articular cavity, as to engage these muscles as auxiliaries in the act of reduction. The surgeon's business is, in short, to reverse the order of events by which dislocation was caused : for, as the partial displacement of the normally contiguous relation of two articulating surfaces is an almost necessary preliminary to dislocation by muscular action, so the reduction of the dislocation must be preceded by restoring that relation as nearly as possible, in order to obtain the assistance of the muscles in the reduction.

The *Hip-joint* presents a marked contrast, in many respects, to the shoulder. Its security against dislocation is due chiefly to the depth of the socket in which the head of the femur plays, and to the strength of its capsule and its interarticular ligament. Yet the muscles immediately surrounding this joint perform a duty similar to that of the corresponding muscles of the shoulder, by acting concurrently with those which are inserted further from the fulcrum. The more limited and feebler movements of the thigh on the pelvis are probably assigned, as their special duty, to the smaller muscles clustered round the joint, which also supplement the action of the larger muscles in the extended movements where more power is required. It may be remarked that the larger masses, constituting the extensors and adductors of the thigh, act more uniformly on the whole lever than is the case in the upper extremity ; whilst the powerful external rotators are grouped more around the articulation, and serve, by their several relations to the joint, before and behind, to help each other in preserving its integrity, and in maintaining the equilibrium of the body in the erect posture. Besides the smaller rotator muscles, the position of the rectus at its origin, and of the psoas and iliacus as they pass to their insertion, is worthy of careful study, in order to appreciate the protection they afford to the joint, especially when it is most needed, viz. : in extension of the limb on the pelvis. This, indeed, is apparently the movement, with outward rotation, which exposes the joint to most risk, as we find additional provision against

displacement in the powerful reinforcement to the capsule which the ilio-femoral ligament affords, and also in the round ligament.

In studying the causes of dislocation of the hip-joint, it is difficult to assign to external violence and muscular action the relative share they have in producing this accident. But it may be safely asserted that the muscles have far less direct influence in this case than in the shoulder; and that position, combined with external violence, determines, to a considerable extent, both the displacement of the head of the bone and the direction of the dislocation. As with the shoulder, it is in that direction in which the articular head is thrown most out of its socket, that it is usually dislocated: and the greater frequency of the backward dislocation is chiefly determined by the advantage with which the more powerful muscles around the joint—especially the adductors—can act in this favorable position by dragging the head of the bone behind the acetabulum; that is when the thigh is flexed on the pelvis and rotated inwards, and thus thrown across the opposite limb. In like manner, abduction of the thigh with rotation outwards favours, by position, the forward dislocation; and force applied either by extension or further separation of the limbs, conjoined with the action of the extensors and outward rotators—especially the psoas and iliacus—completes the displacement. But these accidents are usually accompanied by external violence, as the depth of the acetabulum and the strength of the capsule constitute almost insuperable obstacles, in a healthy limb, to dislocation, by the tilting action alone of the muscles. Unquestionably muscular resistance is the chief hindrance to reduction; which, however, becomes a matter principally of manipulation, when that resistance is neutralised by anæsthetic agency.

In fracture of the upper third of the thigh muscular spasm is often a serious interference with the treatment. The preponderance of the outward rotators has to be combated; and especially that of the conjoined psoas and iliacus, when the femur is broken just below the small trochanter; the consequent tilting of the upper fragment is rarely controllable save by flexion of the thigh on the pelvis. The abductors share in causing these displacements.

The depression in the centre of the acetabulum, and its

occupation by a yielding pad of fat, is an interesting mechanical study. That it subserves the purpose of affording space for the lodgment and free play of the round ligament is manifest : but it is, apparently, designed for a still more important though less evident use. The frequent shocks to which the lower limb is obnoxious are concentrated, by contre-coup, chiefly at the hip-joint. To diffuse this shock as much as possible is an obvious desideratum ; and this is achieved by¹ distributing it around the greater part of the circumference of the acetabulum, and thence to the pelvic bones, thus relieving the centre. Were it not for this arrangement, probably the cotyloid cavity or head of the femur would be more frequently fractured, or the intrusion of the latter into the pelvis would not be the very rare accident that it is.¹

The *Elbow* is a hinge-joint, admitting of flexion and extension, which are limited only by the locking of the ulnar processes into the sigmoid depressions on the base of the humerus. The configuration of the joint, together with its restriction to angular movement, is its defence against dislocation ; and its comparative security due to this cause permits of powerful muscles being affixed to the bones of the forearm, in a position which, considering their attachments, would enable them to act at great advantage in producing dislocation, but for this protection. The sides of the joint are further guarded by strong lateral ligaments ; and fibrous bands are spread over the front and back of the synovial capsule, but not of sufficient density to impede the angular movements ; they are thinner behind than in front. At the elbow the radius is subordinate to, and follows the movements of, the ulna, in relation with which it is firmly held by a strong annular ligament ; and its shallow cup moves on the convex articulation provided for it on the outer condyle of the humerus, in pronation and supination, as well as in flexion and extension. Some fibres of the triceps are inserted into the capsule, and by their action prevent its being nipped by the olecranon during extension of the arm.

¹ This accident I once witnessed in a young woman. The head of the bone could be felt through the abdominal wall, above Poupart's ligament, in a position which admitted of no doubt about the nature of the injury. Unfortunately she left the hospital prematurely and could not be traced.

With such efficient provision against dislocation the muscles cannot be credited with any material co-operation in protecting this joint; but they cannot be absolved from a considerable share of responsibility in the production of the various injuries in and around it, as well as in obstructing their successful treatment. The prominence of the olecranon is an almost insuperable obstacle to dislocation forwards of the ulna, unattended by fracture; and if the infrequent accident of partial lateral dislocation of the two bones occur, it is usually the sequence of external violence, directly or indirectly applied to the elbow. The most common dislocations are those of both bones backwards, and of the radius alone forwards. The two great flexor muscles—the biceps and brachialis anticus—and the great extensor of the forearm, the triceps, are all attached close to the fulcrum, and are direct antagonists; in this respect, therefore, affording the only protection they can to the joint, by neutralising the tendency of each other to disturb its normal relations. The action of the anconeus is merely supplementary to that of the triceps,—probably in perfecting the act of extension: the position of its tendon adds to the protection of the joint. The obstacles to dislocation forwards, besides the prominence of the olecranon, are the resistance of the triceps, and the impracticability of placing the elbow in a position favorable to this displacement. But these impediments exist to a far more limited extent in the displacement backwards; for the coronoid process is relatively small, and the semi-flexed position of the arm favours both the impulse propagated from the hand, and also the advantageous action of the triceps, which the combined opposition of the flexor muscles cannot resist. In like manner, the forward dislocation of the radius alone is, no doubt, due in great measure to the action of the biceps, which has no direct antagonist attached to this bone. The chief resistance to the dislocation of the ulna backwards is the anterior brachial muscle, which must be stretched or lacerated if this displacement be complete; but in most cases it is incomplete. The coronoid process may be fractured, either by its forced contact with the base of the humerus, or by muscular action: but this is rare. Another injury, in the production of which muscular action has a share, is fracture of the olecranon process. Probably this accident rarely occurs without external violence, such as a fall

on the elbow : but the triceps muscle is competent to help such direct violence, by acting in the same way as the extensor of the leg in fracture of the patella. The action of the muscles is the chief hindrance in the treatment of these fractures, and must be neutralised as far as possible by position.

The *Knee-joint* presents even a more striking contrast with the elbow than does the hip with the shoulder. The primary desideratum, indeed, in the construction of the femoro-tibial articulation is the same as that noticed in the scapulo-humeral ; and unobstructed freedom of movement is obtained in a similar way, viz. : by the adaptation of an extended convex surface of cartilage to a comparatively limited and shallow concavity. The frailty inherent in this arrangement is retrieved in great measure by powerful interarticular and lateral ligaments, which simply check without impeding the articular movements, whilst they admit also of a limited amount of lateral and rotatory motion. This compensation is further supplemented by the deepening of the depressions on the tibia for the femoral condyles, provided by the interposition of the fibro-cartilages ; and these subserve the additional purposes of adjusting themselves to the condyles by yielding in the varying degrees of flexure of the knee, and also of assisting to break the shocks transmitted from the foot when the limb is extended. That this property of adaptation of the semilunar cartilages exists is proved by the occasional displacement of the more expanded internal one ; an accident which entirely disables the limb until the normal relation is restored by first flexing and then forcibly extending the leg on the thigh.

A thoughtful examination of this joint and of the functions demanded of it, cannot fail to impress the student with the conviction that the existing arrangement is the only one competent to fulfil these requirements. A locked hinge like the elbow, or one protected by lateral buttresses like the ankle, would be unsuitable, because the leverage, augmented by the superincumbent weight, would act at so great an advantage on the knee that fracture would be of frequent occurrence in either form of construction. This view is confirmed by the difficulty of combining strength and security, with freedom of motion, in an artificial limb, at the knee ;—a difficulty which, I believe, is

not experienced to the same extent at the ankle. It should be remarked that, as the synovial membrane of this articulation is lax where it expands beneath the extensor muscles, the sub-cruræal portion of this mass is attached to the capsule, in such way as to raise it in extension of the limb, and thus secure it from being bruised by the patella.

The share which the muscles have in protecting the knee-joint from injury is auxiliary only in a minor degree, yet not without importance: and the same may be said respecting their agency in producing dislocation, which is mainly due to external violence indirectly applied to the joint. The condyloid insertion of the semi-membranosus most directly fortifies the articulation by supplying its posterior part with a powerful ligament; and a similar function is fulfilled by the insertion of the biceps on the fibular side. The ligamentum patellæ, being the real insertion of the quadriceps, protects the fore-part of the joint; and the strong fibrous expansion derived from the vasti overspreads and shields its sides. The heads of the gastrocnemius are likewise a defence to the back of the condyles, as is also the obliquely placed tendon of the popliteus. The efficiency of these muscles in affording protection to the joint against injury is not merely passive, but becomes more pronounced when most required, *i. e.* when they are actively engaged in the various movements of the limb on the body or of the body on the limb. Little or no muscular resistance is offered to the reduction of the lateral and partial dislocations of this joint. In the more serious accident of dislocation of the tibia backwards or forwards, it is the hamstring and gastrocnemius muscles which are, severally, the most active obstructives to reduction, and which must be humoured by flexion of the knee and extension of the ankle, in attempting to replace the bones in their normal relation to each other. In fracture near the condyles the attachments of the gastrocnemius enable it to displace the lower fragment by dragging it backwards.

Muscular action has a very important share in dislocation or transverse fracture of the *patella*; for both are usually due to this cause, to the almost entire exclusion of external violence. Fracture is the more frequent accident, because the extensor muscles act most powerfully and uniformly on the patella, when its position is favorable to transverse snapping of the bone; *i. e.*

when the knee is flexed. Dislocation outwards, which is the almost invariable form of displacement, depends on the greater power exercised by the external vastus and rectus, which have their origin on a plane external to their insertion, and thus tend to draw the patella in that direction: and the position of adduction and inward rotation favours this dislocation, for the same reason that knock-kneed people are more liable to it. Flexion of the thigh on the pelvis to relax the rectus, and extension of the leg on the thigh to relax the other divisions of the quadriceps, suffice to enable the operator, by manipulation, to effect the reduction.

As regards transverse fracture of the patella, the management of which is often rendered so troublesome by muscular action, probably more success would attend the old-fashioned treatment by position and rest, if more importance were attached to the imperative necessity of sufficiently protracting that treatment, especially when the aponeurotic expansion covering the sides of the joint has suffered much laceration. Fibroid union is but the primary stage of repair: consolidation takes a long time; and embryo fibrous tissue is very extensible. A patient may be allowed early liberty, but only with an extended limb; and this for three or four months, gentle passive motion being employed to preserve the flexibility of the limb. The rare accident of rupture of the rectus muscle or of the ligamentum patellæ illustrates the power of the extensor mass in the neighbourhood of the joint.

The *Wrist-joint* is remarkable in many respects. It is essential it should possess a freedom and variety of movement, scarcely inferior to that of the ball-and-socket joints; yet it enjoys peculiar immunity from dislocation. Some of its functions are associated with the most delicate manipulations; whereas others demand great strength continuously exerted; and it is these latter requirements, conjoined with the great range of movement at this articulation, which necessitates the conversion of a very mobile joint into one which is, practically, almost as fixed as if it were ankylosed. Without such power of adjustment the arm would be comparatively useless. The duty of thus fixing the wrist devolves specially on the flexors and extensors of the hand on the radius and ulna: indeed no other

sufficient explanation offers itself of the presence of such powerful muscles. They act concurrently but as antagonists : and therefore each group neutralises the special function of the other group ; the consequence being that the wrist-joint is, so to speak, thereby obliterated ; whilst the muscles which roll the hand and extend and flex the fingers have the advantage of acting without loss of power, which could not be the case if the wrist yielded. Thus, an effective blow could not be struck, nor a heavy body grasped or lifted with a relaxed wrist ;—a condition which is exemplified in dropped hand from paralysis of the extensors, due to lead-poisoning.

The question of the mobility of the ulna in pronation and supination has been warmly discussed both abroad and at home ; and many learned arguments have been adduced to prove that it must or ought to move. A simple experiment, however, is worth much theorising ; and the following, in which Mr. Anderson kindly assisted me, seems to demonstrate that the radius, with the hand, rolls round the ulna, without any movement of the latter ; describing the incomplete outline of a cone, of which the apex is the humero-radial articulation. The experiment was thus conducted. A partially dissected upper extremity was employed ; and the humerus, with its anterior surface and the palm of the hand facing upwards, was fixed horizontally in a vice which was screwed to the edge of a table, to which the arm was, therefore, parallel. Two pins, six inches long, were fixed in the upper extremity of the ulna, at a right angle to each other ; one being on the same plane as the table, *i. e.* horizontal, the other upright ; the pair being used to render any movement, even the slightest, apparent. Pronation and supination were then practised, without the smallest deviation of the pins from their position. It was further noticed that pronation was arrested before rotation was nearly completed ; in other words that, in complete pronation, about five ninths of the circle were due to rotation of the radius round the ulna, and four ninths to rotation of the humerus at the shoulder. It is true that, in the dead subject, limited lateral movement between the humerus and the forearm is perceptible ; though probably no such movement can take place during life as the result of muscular action. It has, however, been argued that this lateral movement, alternating with flexion and extension, constitutes a spurious circum-

duction ; and that in this way the relation of the upper extremity of the ulnar may be changed, by the action of the muscles, in the way suggested by those who advocate the view that the ulna takes an active part in the rotation. But this proposition requires proof that the elbow-joint is moved laterally during life ; and further that such lateral movement, if it occur, can claim to be regarded, under any circumstances, as rotation of the ulna on the humerus. The appearance during life is singularly deceptive, and is due in great measure to unconscious rotation of the humerus at the shoulder, and partly to the associated movement of the scapula.

The abbreviation of the ulna at the wrist, its dwindled size, and the interposition of a fibro-cartilage between it and the carpus, all indicate the subservient relation of this bone to the radius at this extremity ; and that its necessary presence is dispensed with as far as possible, so that the free mobility of the hand may not be interfered with. Indeed, the principal function of the ulna at the wrist-joint is to steady the radius in its rolling movements, the chief bond between the two bones here being the interarticular fibro-cartilage. Two supinators are opposed to two pronators of the hand, all acting on the radius : such at least is the function with which they are credited. Of these the supinator brevis alone has a special relation to the joint, surrounding, as it does the radio-humeral articulation, and attached to the annular ligament which connects the radius to the ulna. It may, however, be remarked that the long supinator has very limited power in the direction which its name indicates ; and this only in extreme pronation of the hand, as demonstrated by fixing a tense cord to its origin and insertion, and then rotating the forearm. It should be named the flexor longus cubiti : for its chief, almost its only, office is as a flexor of the forearm, to compensate for the loss of power in the biceps when the hand is prone ; as, for instance, in rowing : but when the arm is flexed and prone, the biceps is the most powerful supinator. The flexor carpi radialis assists the pronators.

The four movements at the wrist-joint, antero-posterior and lateral, together with the rolling of the radius round the ulna, impart to the wrist the free mobility which characterises it. An important feature in the lateral movements of this joint is

the greater degree of adduction provided for than of abduction. This is dependent on the shortened ulna on one side, and on the obliquity of the radio-carpal articulation and the prominence of the styloid process of the radius on the other,—points of considerable interest as associated with the injuries near to the wrist. Abduction is effected chiefly by the extensor carpi radialis longior and extensor ossis metacarpi pollicis; and adduction by the conjoint action of the flexor and extensor carpi ulnaris.

Though comparatively superficial, and exposed to violence by falls on the hand, probably no joint in the body is more thoroughly protected from injury by dislocation than the wrist. Observation proves this to be the case; and Dupuytren, in his '*Leçons Orales*,' asserts that, in his large experience, he had never witnessed a single instance of this simple dislocation from accident,—of course in a healthy joint. My own experience confirms that of the great French surgeon: therefore, though the possibility of such an accident occurring may be admitted on the authority of others, we may be satisfied that this injury is very rare. It may be, not unreasonably, suspected that some recorded cases have been really fractures of the radius close to the joint. In seeking for an explanation of this exemption, there are several points to be considered which are worthy of separate attention, especially as the muscles take an active share in protecting the joint: and this consideration will collaterally involve the inquiry, why the radius is liable to fracture at its lower extremity.

The ligaments immediately investing the wrist-joint are sufficiently strong to offer considerable resistance to external violence, without impeding the free mobility of the joint; and a further support of importance, both direct and indirect, is afforded by the annular ligaments, especially the dense anterior one. The tendons around the joint are numerous, and belong to strong muscles; some of these, as the common flexors and extensors, pass, severally, in a common sheath beneath the annular bands, conveniently packed, but so as to provide efficient support to the radio-carpal articulation. Further and supplementary protection is afforded by other tendons confined in their proper sheaths, viz.: those of the flexors and extensors of the carpus on the radius, and of the corresponding muscles

of the thumb. When all these are in action, which they usually are when violence is inflicted, their tendons are like so many tight ligaments around the joint, binding its component parts together, and resisting the tendency to displacement, especially in the direction in which it would be most likely to occur, by a fall on the palm of the hand. Again, the structure of the carpus assists in breaking the effect of shock, communicated from the hand, by the yielding movement of the bones which compose it. But the obliquity of the wrist-joint and its adductibility constitute a very important feature in this consideration, both positively and negatively. The natural obliquity of the articulation between the radius and carpus, exaggerated as it is by the prominence of the radial styloid process, is further increased when the hand is prone, by its adduction. Thus, the shock of a fall on the palm is communicated obliquely to the radial side of the forearm, meeting the momentum due to the weight of the body at an obtuse angle at the wrist-joint, where the effects of the conjoint shock are resisted by the whole flexor mass beneath the annular ligament, and especially by the flexor carpi radialis and long flexor of the thumb, and also by the projecting styloid process of the radius.

But we must search still further for an explanation of the extreme rarity of simple dislocation of the radius at the wrist; and I think it is to be found in the fact that the violence which might otherwise imperil the joint is expended on the lower end of the radius, which gives way by fracture. To a casual observer this fracture is a perplexing problem. A lever is broken at its most expanded part, near its extremity and close to a movable joint. A consideration of the structural relations just adverted to will help to solve this difficulty. They may be thus enumerated. The ready adduction of the hand and consequent drag on the external lateral ligament; the prominence of the radial styloid process to which this ligament is attached; the obliquity of the articulation, and the propagation of the force of a blow on the palm towards the styloid side of the radius; and possibly the action of the supinator longus. To these may be added the circumstance that the cancellous texture, which constitutes the bulk of the radius at its carpal extremity, is enclosed in only a thin layer of compact tissue,

incapable of resisting much violence. Under the conjoint influence of these agencies the radius gives way near to the joint, and thus assists, negatively, in warding off a dislocation. The treatment of these fractures resolves itself into allowing the prone hand to fall into a flexed position; and this involves adduction and, therefore, traction on the external lateral ligament, and consequent antagonism to the resistance of the supinator longus and radial extensors, together with relaxation of the pronators;—all which circumstances constitute a practical commentary on some of the foregoing remarks.

The *Ankle-joint*, though in some respects resembling the wrist, presents also many points of striking contrast with the latter. It is an angular hinge-joint, but admits of some lateral movement, which, together with the gliding motion allowed between the tarsal bones, and the general elasticity of the foot, affords the necessary protection by yielding in walking or running, and especially when the sole of the foot is brought into contact with an uneven surface. I am aware that lateral movement at the ankle-joint is denied by some anatomists. But I am persuaded, from experiment, that though this motion is precluded in extreme flexion of the foot on the leg, it exists to an obvious extent in the living subject even when the foot and leg are in a rectangular relation to each other; and this quite independent of any movement between the tarsal bones. I speak both of that movement which consists of inversion and eversion of the sole of the foot, and also of that form of rotation of the foot by which the toes are adducted and abducted: the latter is due in part, but not entirely, to rotation at the knee-joint. These lateral movements are limited by the projecting malleoli and the strong ligaments attached between them and the tarsus. The resisting power of the ligaments is demonstrated by the fact that they are scarcely ever torn, though often painfully stretched: whereas the malleoli themselves are very commonly broken by force applied through these fibrous bands, the astragalus acting as the fulcrum. Indeed, the security against dislocation, provided for by the anatomical construction of the joint, is so complete, that the fracture of one or both of these prominences, or of the fibula higher up, is an almost necessary condition of displacement: but when they are frac-

tured, dislocation is a frequent sequence, from the loss of support thereby entailed.

The integrity of the ankle-joint, in its various movements, is to a considerable extent indebted to the muscles which surround it. Their value is also manifested in preserving the arched form of the foot. Although all the muscles around the ankle take part in maintaining the erect posture by poising the tibia on the astragalus, it is especially the function of the tibiales and peronei, which may be regarded as the homologues of the flexors and extensors of the carpus on the radius and ulna. The additional power of the gastrocnemial mass counteracts the tendency of the body to fall forwards, when the centre of gravity is disturbed, by acting on the condyles of the femur, and also advantageously on the extremity of the lever into which it is inserted, which is farthest from the fulcrum. The relation of the malleoli to the posterior tibial and flexor muscles of the toes on the inner side, and of the peronei on the outer, probably explains the rarity of dislocation of the foot forwards; whilst, on the other hand, the gastrocnemii may be credited with a considerable share in determining the less infrequent accident of displacement of the foot backwards. But these accidents about the ankle-joint, involving, as they nearly invariably do, fracture of the fibula or inner malleolus or both, are almost entirely due,—with the above exception and possibly in rare instances of fractured os calcis,—to external violence pure and simple. It is in their treatment that we have to take account of the muscles, which often resist reduction in compound dislocation; and also perpetuate their opposition to the surgeon's efforts to maintain a favorable position of the injured limb. They must be humoured and soothed by being relaxed; this is far better, where practicable, than to provoke them by the effort to tire them out. Such irritating management has often more than a locally mischievous consequence, by disquieting the nerve-centres in a way highly prejudicial to the patient.

The question of tenotomy under these circumstances naturally presents itself. Certainly it is not only admissible but desirable, in some instances, to divide the tendon of an intractable muscle, especially if required for the reduction of a compound dislocation or fracture; but in fracture I generally prefer to remove

a portion of the protruding bone. This practice of cutting tendons does not, in my experience, realise what might be anticipated from it theoretically. Fresh combinations in the unopposed action of other muscles develop themselves, which are as unmanageable as those we sought to evade or remove: it is better, under these circumstances, and unless the indications for interference cannot be mistaken, "to bear the ills we have, than to flee to others that we know not of."

In the *Carpus* the os magnum, and in the *Tarsus* the astragalus, are more frequently dislocated than any of their associates. But these displacements are altogether independent of muscular action. Such is not the case with the phalanges, where the agency of the muscles, in the production of dislocation, may frequently be traced, in concert with that of direct violence. This is exemplified in the case of the great toe and thumb, the displacement of which is often troublesome to reduce, owing to the resistance of the muscles added to the obstruction offered by the lateral ligaments.

The principal reasons why the *Clavicle* is not more frequently dislocated are, that it yields to external violence, and gives way more readily by fracture. Both ends are preserved in their respective relations by strong ligaments: and powerful muscles are attached to them, which, though they have little or nothing to do with either dislocation or fracture of this bone, are vexatiously instrumental in thwarting the treatment of these injuries. The trapezius and deltoid in great measure neutralise each other's action on the clavicle; and this is also partially the case with the great pectoral and subclavius, and the sterno-mastoid. No doubt the difficulty of keeping in place the dislocated acromial end of the clavicle is in great measure due to the flatness of the articulation and its dependence for its security on the integrity of its ligamentous connections: but the relations of the fractured bone are determined usually by the weight of the shoulder, and the action of the great pectoral muscle which draws the outer fragment downwards and backwards, whilst the sterno-mastoid elevates the inner fragment; or, more correctly speaking, prevents it from being depressed. Position and support are the only remedies for these difficulties.

Dislocation of the condyles of the *Lower Jaw* occurs just as does dislocation of a ball-and-socket joint, viz. : by the convex articulating surface being placed in a position favorable for muscular action to displace it. This occurs when the mouth is widely opened, as in gaping ; and the horizontal pterygoid muscles drag the condyles forwards over the articular eminences, into the fossæ in front of them. In that position they are retained by the conjoint action of all the closing muscles of the jaw ; and the reduction must be accomplished by manipulation and conquering the resistance of the muscles ; after which the displaced bone is returned to its normal position by their agency.

The action of muscles on particular joints, when *diseased*, scarcely admits of being specialised with any advantage. Such action is generally, if not always, due to the completion of the reflex circle, starting from the diseased tissues of the joint, and terminating in its motor muscles. The position of a limb, assumed under these circumstances, is partly due to the instinctive endeavour to obtain relief ; but still more, probably, to the preponderating power of the strongest of the contending muscles. Thus, in hip disease, the natural tendency is to angular flexion at the hip and knee, and to extension at the ankle-joint. Neglect or ill-advised and weak compliance with a patient's entreaties is the cause of many deformed and crippled limbs, where joints have been diseased, and muscular action has been unrestrained or ruthlessly opposed. Gentle coercion, if employed in time, rarely fails to afford relief, accomplishing at the same time all that is required in regard to rest and position. The remarks concerning tenotomy in injury are of still more force in their application to disease. The cases are, indeed, few which would justify recourse to this operation during the early or active stage of joint disease ; though the efficacy of such treatment cannot be denied in some instances of deformity resulting from the rigid resistance of muscles, consequent on long-continued acquiescence in their perverse action.

The integrity of joints, which is due to their osseous configuration, the fibrous tissues connected with them, and the muscles which surround and move them, is dependent in

different degrees, according to circumstances, on each of these sources of strength and protection; insufficiency in any one of them being supplemented by increased efficiency in the others. As a rule the arthrodial joints admit of but limited motion, and are amply protected by their fibrous envelope, as is notably the case in the scapulo-clavicular, tarsal, and costo-vertebral joints. The angular hinge-joints—the elbow, ankle and phalanges—depend chiefly on their osseous form, supplemented by lateral ligaments, for their security: but the lateral hinge or rotating joints—the radio-ulnar and upper vertebral—rely exclusively on powerful ligaments for their integrity. The two enarthrodial articulations are unequally dependent on extraneous assistance for their protection from injury; because the one has a very shallow cup, and is endowed with almost unlimited mobility both in variety and extent; whereas in the other a globular head is received into a deep cup, to which it is connected by an interarticular ligament.

The knee-joint is almost *sui generis*, though it is more allied to the angular hinge than to any other form of articulation. It is certainly the most complex joint in its complete equipment, though very simple in its skeleton state. Its expanded surface, interarticular fibro-cartilages and crucial ligaments combine, with the broad internal lateral and other exterior ligaments, to constitute the knee one of the strongest joints in the body.

The influence of *atmospheric pressure* in assisting to preserve the integrity of joints is common to all; but in none is it so well exemplified as in the shoulder. If this joint be placed within the receiver of an air-pump, after the capsule has been carefully dissected, immediately on exhaustion of the air the weight of a few inches of the humerus suffices to produce dislocation; but, on re-admission of the air, the head of the bone again rises into contact with the glenoid cavity. When the shoulder drops, in consequence of paralysis or wasting of the muscles, the elongated capsule is occupied by synovia;—a pathological demonstration of the value of these muscles in retaining the head of the humerus in its normal position.

The action of different muscles on the joint may be usefully illustrated by attaching strong india-rubber bands or cords to

the skeleton, in positions to represent the attachments—origin and insertion—of the principal muscles disposed around the joints; to the exclusion, of course, of any other connecting medium between the bones. If a joint be then moved into the position in which experience has shown that dislocation is produced most readily by muscular action, the elastic bands, by imitating that action and with the assistance of a little manipulation, exemplify the mode in which it operates in the living subject. This remark applies chiefly to the ball-and-socket joints; but the method is also available for demonstrating certain deformities consequent on fracture near to joints.

SOME RECORDS OF SURGICAL EXPERIENCE,

BEING A CONTRIBUTION TO THE

COLLECTIVE INVESTIGATION OF DISEASE.

(Continued from 'St. Thomas's Hospital Reports,' N.S., Vol. XVI, p. 29.)

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Separation of bony epiphyses.—Fracture of zygoma.—Fractures of metacarpus and metatarsus.—Ganglia and bursæ.—Necrosis of bone.—On some causes of error in surgical diagnosis.—Gall-stones.—Fatty tumours.—Enchondroma of pelvis.—Galactocoele.

The separation of bony Epiphyses is more common in the upper extremity than in the lower. These injuries are not always readily distinguishable from fractures, and the diagnosis between the two is not very important, inasmuch as the treatment is the same in both. But they also resemble dislocation, and the error in diagnosis in this case is serious. The following cases, selected from among my notes exemplify this form of injury.

A gymnast, æt. 18, was performing on the trapeze, and whilst hanging by his feet and trying to draw up his body between his legs, he felt something give way on the left side of his neck. This injury was at first diagnosed as a disloca-

tion of the sternal end of the clavicle, and unavailing attempts were made to reduce the displacement. When I saw the patient the swelling had abated, and I was satisfied that the sternal epiphysis was separated from the shaft of the bone. The inner end of the shaft rested upon the sternal epiphysis of the bone, the latter occupying its normal position in relation to the sternum. The case was treated as one of ordinary fracture of the clavicle. An interesting feature in this case is the mode in which the accident occurred. There was no evidence of violence having been directly applied to the injured part: the accident was produced by muscular action during the violent effort made by the patient in performing his gymnastic feat.

A lad, æt. 16, was admitted into the hospital in consequence of a fall down a flight of steps, whereby his head, shoulder and side were contused. The shoulder was swollen, and the deformity was thereby masked. Crepitus of a muffled character was elicited most readily by moving the arm backwards and forwards, especially when the hand was pressed up into the axilla: the pain was referred to the front of the joint. When the swelling had subsided a large pad was placed in the axilla, and the shoulder was covered with a pasteboard cap. The boy soon recovered the use of the arm, and was dismissed at the end of a month.

A lad, æt. 15, fell with violence upon his outstretched hand. My curiosity was somewhat excited by being informed that the injury incurred was a veritable dislocation of the wrist. The supposed dislocation had been reduced, but immediately the support was removed from the joint the hand fell, and the radius projected backwards on the carpus. A brief examination sufficed to satisfy me that the case was one of separation of the epiphysis of the radius, which was thus carried forwards in company with the hand, the base of the bone being left, deprived of its articular extremity, projecting on the back of the carpus. The source of the error in diagnosis was the similarity in the form of the base of the radius, minus the epiphysis, to that of the perfect bone. The diagnostic difference is in the interval between the base of the middle metacarpal bone and the projecting extremity of the radius, which is of course greater when the epiphysis accom-

panies the carpus ; but more especially in the noticeable fact that the styloid process is identified with the carpus in its movements, and distinctly isolated from the radius. Moreover, if this joint can be, or ever is, dislocated, it would surely not be so readily reducible as in the form of injury I am speaking of. I had an opportunity of dissecting a precisely parallel case to this, and I believe the preparation is in our museum. The treatment, in the present case, consisted in confining the hand and wrist in gutta-percha splints, moulded to the entire palm and the lower part of the forearm, both before and behind. Passive motion was commenced at the end of three weeks, and the boy recovered a useful limb, there being free motion in every direction, and scarcely perceptible deformity.

Fracture of the Zygoma is a rare accident : the following is an instance. A young man applied to me under the following circumstances. He was totally unable to separate his jaws or to move the lower maxilla in any way. He said that, two or three weeks previously, he had been struck on the cheek with a policeman's truncheon, and pointed to the left zygomatic arch as the spot. Here the bone was depressed, and the tissues around were a good deal thickened. It was evident that the broken arch was driven in, and that callus was already thrown out in considerable abundance ; for two or three weeks had elapsed since the injury was received, and the trismus had become gradually more confirmed day by day. Of course there was nothing to be done for him, as I declined to use force to separate the jaws, anticipating that nature would accomplish this in due time : and such proved to be the case, for the patient entirely recovered, and there was very little deformity left at the seat of injury.

Fracture of the Metacarpal and Metatarsal bones is caused usually by force applied, as in the case of fractured zygoma just related. A sharp blow or the fall of a weight on the hand or foot is the usual history of these accidents. I have several such cases—though they are not very common—in my note-books. Their diagnosis is so easy, and their treatment so simple, that the narration of these cases is superfluous. It is possible, however, that these injuries may be

overlooked when there is, as is usual, much swelling: it is, therefore, judicious, where the nature of the accident points to this result, *i. e.* fracture, to defer a positive opinion till a more thorough examination can be made. The neighbouring bones form natural splints, therefore rest in a suitable position is all the treatment that is needed.

True *Ganglia* are always offshoots from, or associated with, tendons and their thecæ: they are essentially abnormal productions. *Bursæ*, with which they are sometimes confounded, are, very generally, of normal existence, but subject to morbid development from mechanical irritation. But bursæ may be developed where they are not naturally present, apparently by expansion of the meshes of the areolar tissue, when subjected to pressure or friction. Both ganglia and bursæ may become troublesome, and require treatment to abate the inconvenience of their presence or size. If such treatment be by surgical operation, necessary precautions must be taken to avoid consequences far more serious than the disease. I have very little confidence in absorbent applications: I do not know that I ever saw iodine alone of any service. Its application after a blister is useful; but when that treatment is adopted, I believe it is chiefly the blister which does the good. Pressure, where it can be properly applied, is efficacious; but especially so in the treatment of ganglia, as on the wrist, after subcutaneous puncture of the cyst. For this purpose I use a long and broad lance-shaped needle, fixed in a handle: this I pass through the skin at $\frac{1}{2}$ or $\frac{3}{4}$ inch from the ganglion, which I open subcutaneously, and having pressed out its contents, with the ball of the thumb, into the surrounding areolar tissue, I place on the spot a piece of sheet lead or a small coin, wrapped in linen, keeping it bound on for a few days.

It is, I think, rarely admissible to meddle with bursæ by operation, on account of their susceptibility to inflammation. An open blister, or a repetition of blisters is the best treatment as well as the safest, where any is required.

There is one form of this complaint, which is a serious mechanical inconvenience as well as very intractable: it is that of a synovial swelling, extending above and below the

annular ligament of the wrist, and into the palm of the hand. It is difficult to classify this swelling with either of the forms spoken of. It is certainly a development from the synovial surrounding of the flexor tendons; but in its external characters and pathology it partakes much of the character of bursæ. I would rather incise a swelling of this kind than puncture it: but I think either step would be fraught with considerable risk. Repeated blistering, followed by uniform pressure from the fingers to the elbow, is the best treatment. The utmost that can be expected, in my experience, in these cases, is to mitigate the evil without curing it. I remember an instance in my early practice, where I rather rashly punctured a large bursa beneath the semi-membranosus tendon behind the knee, and nearly lost my patient from the phlegmonous inflammation of the leg which followed.

Necrosis of bone is a well-worn subject. The experience of every hospital surgeon supplies him with a multitude of cases of every description. The recognised treatment of the disease admits of but little variation, except in the details applicable to individual cases. The time to be selected for operating is an important detail; and I think the selection is more often made prematurely than delayed too long. Where the suppurative drain is telling on the patient's health or producing hectic, an early operation, however the difficulty may be thereby enhanced, is the preferable alternative. But, where the patient's health is well sustained, the longer nature is permitted to act upon the sequestrum the easier does its removal become.

Necrosis of bone is usually the consequence of an acute inflammatory action, either in the bone itself or its periosteum, or, more rarely, in its interior. It is not, except in rare instances, a degenerative action, as caries usually is. A very frequent cause to which necrosis is originally assigned is mechanical injury, aided often by accidental predisposing causes, such as exposure and hardships of various kinds. In such cases the structure of the bone itself is often primarily affected. Where the inflammation is due to the agency of cold and wet clothes, the periosteum is the tissue first affected. In one of a series of Clinical Lectures which I delivered in the

Hospital in 1861, and which was published in the 'Medical Times and Gazette' I narrate several cases illustrative of extensive necrosis, in order to direct attention to points of considerable importance in the early diagnosis of these cases. I will briefly quote one of these to exemplify the practical points in question. The history is that of a boy, *æt.* 12, who was healthy until, after repeated exposure to wet, he was attacked two months previously with fever, the right knee and shoulder becoming, at the same time, much swollen and tender. His medical attendant appears at first to have regarded this attack as rheumatic fever; but the symptoms being of a low type, he afterwards pronounced the fever to be typhus. Ten days before the boy's admittance into the hospital the shoulder suppurated; and in a week subsequently the bone protruded. When admitted he was emaciated and feeble, pulse weak, and tongue red and glassy. Just beneath the acromion the upper extremity of the shaft of the humerus, separated from the epiphysis, was extruded through an ulcerated opening in the skin, to the extent of about an inch. The granulations of the red and swollen edges adhered to the exposed bone. Under a generous diet the boy's health improved; and after the lapse of two or three weeks, I was enabled, by detaching the protruding bone from its surrounding connections, to loosen and withdraw the large sequestrum. This required considerable force; and the necrosed portion included fully half of the shaft of the bone. Continuity between the sound lower half and the head of the humerus was established. The arm was somewhat shortened, but the head of the bone followed the movements of the new shaft. The boy recovered, with a fairly useful limb.

I have, in my note-books, a similar case in a boy *æt.* 13, who had been under my notice for a considerable time, and in which I contemplated the necessity of amputating at the shoulder-joint: but I was at length enabled to remove the entire shaft of the humerus. He was discharged from the Hospital with a good arm, using it freely, and with good motion at both shoulder- and elbow-joints. There was not even an open sinus remaining. This case was, I think, reported in the 'Lancet,' about the time it occurred, 1853.

The former of these two cases exemplifies a not infrequent

source of fallacy in the diagnosis of acute osteitis. Simple fever, as well as rheumatic and typhus fever, are associated with the local disease, and are made to appear, as they often are supposed to be, its *cause*, instead of being regarded, as I believe that usually they really are, as constitutional effects or concomitants of the local disorder. This is a point of considerable practical importance, as it may mislead the practitioner into treating the effect, whilst he ignores the active cause.

Osteitis and necrosis of bone may be a sequence of fever in some of its forms ; but I believe this is much more rare than is usually supposed, for the reason assigned. When it so occurs, it does not succeed the early stage of the fever, but is rather a later consequence of blood-poisoning.

Acute inflammation of bone runs its course rapidly, and is, unfortunately, not very amenable to treatment : but the more chronic forms are more misleading in their early stage. The most quickly fatal cases are those in which the patients succumb to what appears to be an acute attack of fever, attended by pain and swelling in some part of a limb or near a joint. The autopsy demonstrates the presence of acute osteitis, followed by suppuration and pyæmia, as the cause of death ; and this, perhaps, within a few days of the first appearance of the symptoms.

The transfer of pus to some other organ is not infrequent as a consequence of acute osteitis. The explanation of this circumstance is not very clear ; but it is probably due, in a measure, to mechanical facilities afforded by the venous circulation in bones : for it is found that not only is the periosteum ripped up, and the cancellous texture loaded with the products of acute inflammation, but pus is also found pervading the Haversian canals of the compact tissue. The veins are probably involved in the inflammatory action : but ulcerated openings in their walls would facilitate absorption, where the density of the surrounding texture does not permit of the ready diffusion of the rapidly secreted pus and other inflammatory products.

In these cases of acute inflammation of bone, terminating speedily in suppuration, we find pus deposited between the periosteum and bone, separating them from each other, and

entailing loss of vitality, perhaps of the surface of the bone only ; or, if the inflammation have extended deeper, there may be necrosis of the entire thickness of the shaft, and pus will then be found in the canal of the bone.

It is rarely that the epiphyses are involved in the destructive process, the necrosis being limited to the shaft, as exemplified in the cases narrated, and in another instance under my care, in which the entire shaft of the femur was removed in a necrosed state, and the patient recovered with an useful limb. These cases of death of the whole shaft of a long bone are not common, and the diagnosis of the extent of the mischief is not always easy. The amount of discharge through sinuses is no sure guide ; for it is remarkable how much irritation and suppuration may be caused by a small sequestrum. When necrosis affects the cancellous texture of the epiphysial end of a long bone, the mischief not infrequently extends, by contiguity, to the joint, the invasion of which is marked by sudden and acute aggravation of symptoms and serious constitutional disturbance. Having noticed this condition in several instances of excision of the knee-joint, I am disposed to attribute, in such, the articular disorganisation to the extra-articular necrosis as the primary disease ; though, doubtless, in some cases the joint affection may be antecedent to the adjacent necrosis.

The proper time to select for surgical interference is a question of the utmost importance. The looseness or otherwise of a sequestrum is a guide, but an uncertain one : for this depends on the accidental circumstances of position, size, accessibility, &c. The abundance of the discharge is also untrustworthy by itself, for the reason just now mentioned. The history of the attack, the length of its duration, and the general condition of the patient must determine the surgeon. It is rarely justifiable to delay where hectic fever is present. A patient in this condition will bear the shock of a protracted operation better than the wearing influence of profuse suppuration. The absorption of the animal element of the bone is accompanied by the disintegration of the inorganic material, and its discharge, in solution or in minute particles, in the pus.

On some causes of Error in Surgical Diagnosis.—Amongst the sources of error in diagnosis may be mentioned certain deformities indicative of conditions which do not really exist, but dependent on other forms of injury or disease, or upon special habits or occupation. The following cases exemplify these misleading peculiarities.

1.¹ A young woman was admitted into the Hospital, suffering from numbness and shooting pain in the shoulder, which had troubled her for twelve months. On viewing the shoulder from the front, its form was immediately suggestive of a dislocation of the head of the humerus into the axilla. The acromion stood out prominently, all rotundity was lost, and the finger could be placed almost in the glenoid cavity, the humerus having dropped considerably, consequently on atrophy of the deltoid and capsular muscles; and all power of movement was lost. On examination an abscess was found, occupying the pectoral region, and extending in front of the shoulder. Fluctuation could not be detected in the axilla. A large quantity of fetid pus was withdrawn through an opening over the pectoral muscle. The patient's condition improved slowly; and with that improvement the deformity of the shoulder diminished. It is scarcely necessary to remark that a similar deceptive appearance results from any injury paralysing the shoulder muscles, or from joint disease entailing dropsical or purulent effusion into the capsule.

2. A blacksmith was admitted, with a fracture of both bones of the leg, which was put up on a long back splint, the fractured ends being in good position. A few days afterwards my attention was attracted by the position of the patella in relation to the foot, which showed great inversion of the lower part of the limb, for the knee-cap looked almost directly inwards. As the sound limb presented no similar deformity, I directed the attention of my dresser to the supposed displacement, and requested him to give it careful attention. As no improvement in this respect was apparent at my next visit, and as the fracture presented no evidence of corresponding displacement, I was induced to make some further inquiries, which led to my ascertaining that the deformity in this, his right limb, was due to the peculiar

¹ Some of these cases were reported in the 'Med. Times and Gazette' in 1863.

position in which he stood when he wielded the sledge hammer which he used at his work.

3. A stout, muscular man was thrown from a cart, and fell on his shoulder. There was much effusion and extravasation of blood. The arm hung, powerless, by his side, and there was hollowing over the head of the bone, giving decided prominence to the acromion. This was a condition suggestive of fracture of the neck of the humerus, especially as there was free passive mobility at the joint, accompanied by total inability to raise the arm from the side. But no fracture could be detected: the depressed head of the bone could be felt rotating beneath the finger when the humerus was moved, and the deformity was obliterated when the bent elbow was simply lifted: moreover there was no crepitus, nor abnormal prominence in the axilla when the arm was raised. We had to deal with a case in which the severity of the local shock had paralysed the muscles and caused effusion into the joint. The use of the limb was gradually restored as the severe bruising subsided; but the patient continued to complain, for some time, of pain along the course of the musculo-spiral nerve.

In this case probably both radial and articular nerves were contused; and I may remark that even slighter contusions of the shoulder will produce this painful and intractable paralysis of the muscles around the joint. The treatment which I have found most efficacious in these cases, when they become chronic, is repeated blistering till the pain is relieved, and the subsequent employment of electricity.

4. A saddler of middle age was the subject of a dislocation of the shoulder-joint, which I reduced after the lapse of a considerable interval from the receipt of the injury. Though there could be no doubt about the head of the bone being restored to its articular cavity, I was a good deal perplexed by a continuance of very marked deformity in the joint, the shoulder being more flattened and lower than the other. On inquiry I found that the man had been accustomed to carry heavy weights on the opposite shoulder, which was the cause of the contrast and of my misgivings respecting the completeness of the reduction.

5. Deformity from habit, with which the above case may

be classed, is not infrequent. A young man who was under my care for in-growing nail, which had troubled him for some time, and was cured by first removing the exostosis which was the original cause of it, had acquired the habit of relieving the tender foot by walking with a stick and raising the opposite side of his body. The consequence is that, after the lapse of two or three years, he still carries one shoulder considerably higher than the other. A fixed position, in which the spine is bent to one side, is not infrequently productive of spinal deformity, as is well-known : but a careful investigation of the cause of the mischief in young people, and its correction might be studied a little more with advantage. Care should also be taken that, in correcting one deformity we do not entail another ; which occurred to me in an effort to prevent contraction in the healing of a burn involving the axilla. An apparatus which I had made to keep the arm separate from the side was producing lateral curvature of the spine by inducing the patient, a boy, to lean to that side to relieve the tension produced by the instrument. Fortunately I discovered the commencing mischief in time to stay it. The secondary effects of spinal curvature, though very perplexing and misleading to the uninitiated, are generally too well understood by the practitioner to need comment.

Hysteria and intentional dissimulation are responsible for much that is deceptive and misleading in diagnosis. It is difficult to draw a defined line between that which is due to hysteria, and that which is feigned,—apparently for the sake of attracting sympathy,—for the simple reason that it is hysterical young women who are usually most disposed to assume complaints which they have not : but it behoves the practitioner also to beware of the artful tricks of those who, for less venial purposes, practise on their credulity. I have treated of this subject in another paper, and I will now confine myself to a few deceptive conditions which present themselves to surgeons, many of which, including deformities, have come under my notice. Not only is functional derangement simulated, but organic disease is imitated. The breast is liable to an affection recognised as hysterical, in which this organ is the subject of acute pain and, sometimes, accompanied by considerable swelling and hardness. In some instances there

is a defined tumour, which naturally alarms the patient, and might excite the surgeon's apprehension, if he were not acquainted with its true character. Again, the urinary organs are often the seat of derangement. There may be symptoms simulating stone in the bladder, or the quantity of urine secreted may suggest the fear that diabetes is present. But the most common affection of these organs, in women, is that of real or assumed retention of urine. Some remarkably persistent cases of this kind have come under my notice, which, if simulated, manifest a marvellous resistance to the demand for evacuation of an enormously distended bladder. Spinal pain and localised tenderness is another frequent complaint of hysterical subjects, which may mislead the surgeon. But the tenderness in these cases is by no means proportioned to the firmness of the pressure made to elicit it: on the contrary, very light pressure is generally most complained of. The same remark applies to simulated peritonitis: in both cases the tenderness is really confined to the cutaneous surface. Perhaps the most remarkable instances of this class are those in which diseased and stiffened joints are imitated. The knee is often the subject of this affection, and sometimes the hip. I will cite a case to illustrate the deceptive character of this affection, and the best mode of detecting the illusion. A young girl, about eighteen, had been confined to her bed for some time, under medical advice, with supposed hip-disease. When I saw her in consultation, the leg and thigh were drawn up in a rectangular position, suggesting an advanced stage of hip-disease; and I found the joints were rigidly fixed, and that great pain was excited or complained of on any attempt to move them. Before proceeding further I directed that chloroform should be administered; and immediately the patient was under its influence all resistance at once ceased; the limb could be restored without difficulty to its normal form, and all its movements were perfect. Of course directions were given to keep it straight.

Gall-stones.—Two instances of very large gall-stones have come under my notice; one in my own practice, the other in the person of a neighbour and friend, who was under Dr. Alliot's care. I will first narrate very briefly my own

case,¹ which terminated fatally, and then the case under Dr. Alliot's care, which recovered.

I was requested to see, in consultation, a stout lady, æt. 58, who was suffering from obstinate constipation. Eight months previously she had a similar attack, which was relieved: then a hard tumour was perceptible in the right hypochondrium. When I saw her, pain was severe and there was stercoraceous vomiting. She was relieved by free injections of warm water and friction of the abdomen with castor-oil.

Two months later a similar attack, accompanied by severe pain and a hard tumour near the cæcum, terminated fatally in a week. There was no appearance of jaundice on this occasion or at any previous time. The immediate cause of death was an ulcerated opening in the ileum, which had permitted the escape of several small biliary calculi into the peritoneal sac. Two large gall-stones occupied the ileum close to the cæcal valve. The gall-ducts were thickened and dilated, but the gall-bladder was healthy and quite free from adhesion to the intestine. Each of the large concretions measured an inch in length and was four inches in circumference. They consisted of 95 per cent. of cholesterine and 5 per cent. of animal matter.

Mr. B—, a gentleman over eighty years of age, was the subject of the other case. There was no history of any previous attack, or of anything suggestive of local peritonitis. The symptoms were urgent, and continued unabated for a week: there was much pain, constipation, stercoraceous vomiting and collapse. The treatment consisted in giving belladonna and opium internally, and gently kneading the abdomen over the right hypochondrium, by which the obstructing mass, which could be felt, was moved on. The relief of the urgent symptoms was sudden and complete, and a large biliary calculus, an inch and a half in length and three quarters of an inch thick, was soon afterwards voided *per anum*.

In a fatal case under the care of Dr. Bristowe, the remains of the gall-bladder, which was small, communicated directly

¹ This case was published in full, with illustrations, in vol. lv of 'Med.-Chir. Trans.'

with the intestine ; and a gall-stone had lodged in the small intestine, which it obstructed, apparently from spasm of the bowel. A case, very closely resembling mine, is narrated by Dr. Pye-Smith, in the 'Proceedings' of the Pathological Society, 1887, in which the patient recovered, never having suffered from either jaundice or biliary colic.

It is a subject of curious speculation how these large concretions find their way into the intestine. The supposition that a small stone, which has passed the gall-duct, may afterwards grow in size by the deposit of fresh material, seems to be inadmissible ; inasmuch as such accretion must have taken place near the mouth of the duct or not at all : and it is scarcely conceivable that the duodenum would tolerate the presence of such a body without passing it on. Moreover the constituents appear to be unmixed with foreign matter. If, then, the full-grown stone passed from the gall-bladder into the intestine, how was the passage accomplished ? The previous history in these cases throws very little light on the subject. The absence of jaundice seems to forbid the idea that the gall-duct had been obstructed for any time : moreover there was no history of the acute suffering which attends such obstruction. It is, however, not improbable that adhesion between the adjoining surfaces of the gall-bladder and duodenum or possibly the colon, and the subsequent formation of an ulcerated opening, might have been accomplished without any important local symptoms : and such appears to be the most probable solution of the difficulty, as was evidently the case in Dr. Bristowe's patient. But in my case there was no trace of any such communication having been established, the gall-bladder being healthy and free from adhesions. Is it possible for the gall-duct to admit of such distension as to allow a solid body, four inches in circumference, to pass through it ? I think not ; at any rate without the manifestation of unequivocal symptoms at the time. Indeed it is difficult to conceive what force could be exerted to accomplish the transit, or how so delicate a duct could permit such dilatation. Altogether it seems most probable that the transfer of the calculus to the intestine is effected by ulceration of the adjoining surfaces of gall-bladder and intestine ; and that, in some cases the indications of this

process have become obliterated. The subsequent chief obstruction would occur, as in my case, at the ileo-cæcal valve; and so long as the calculus remained impacted against it, the passage would be permanently blocked, and the urgent symptoms would be those of mechanical obstruction, which may admit of temporary relief by the change in position of the stone: the only spontaneous recovery is in the cases where it escapes into the large intestine and is passed *per anum*, or, in rare instances, is discharged through the wall of the abdomen. An interesting exemplification of the latter form of relief has been communicated to me by my friend and former dresser, Mr. William Clapton, in whose practice the case occurred. The gentleman, whose age was 38, had been the subject of attacks of jaundice on various occasions during the preceding two years; and at an early period of this time a swelling appeared over the region of the gall-bladder. This subsequently assumed a more defined character, and proved, when opened, to be an abscess containing several small biliary calculi, which were removed. No bile was found in the abscess. The patient made a slow but good recovery.

A very interesting case of relief from a large gall-stone, by operation, is narrated by our assistant surgeon, Mr. Clutton, in vol. xxi of the 'Transactions of the Clinical Society,' just published. The subject was an elderly woman, who had suffered from jaundice and abdominal tenderness fifteen months before, after which she passed a large biliary calculus *per anum*. Ever since that time, until just before the operation, a tumour had been felt in the position of the gall-bladder. Its disappearance was followed by obstinate intestinal obstruction, for which Mr. Clutton performed laparotomy, incising the abdominal wall below the umbilicus. The stone was readily felt, tightly impacted in the ileum, about eight inches from the ileo-cæcal valve. It was pressed on till it reached the valve, and subsequently, after some resistance, through the valve. The stone was passed, with a motion, on the fifth day after the operation, and the patient, a female aged 70, made a good recovery.

In this case the earlier symptoms seem to point to the probability of the calculus having passed, by contiguous adhesion and ulceration, from the gall-bladder into the intestine.

I will conclude this paper by narrating from my note-books two or three somewhat rare cases, which occurred in the latter years of my connection with the Hospital.

Fatty tumour.—This case, which is remarkable from the position of the tumour, occurred in the person of a young married woman; and her account of herself was, that about five years previously she observed a moderately firm swelling, of small size, above and to the outer side of the right mamma. As this increased in size it rose towards the clavicle; but as it was neither painful nor inconvenient, she was recommended to have nothing done to it. Latterly, however, the swelling had reached the clavicle, and then made its way beneath it, appearing, as large as a small egg, above that bone. She then complained of numbness, loss of power, and some pain in the arm, indicating pressure on the brachial nerves. The tumour was diagnosed as fatty, and such it proved to be. The operation for its removal was commenced by a free incision along the lower border of the outstretched pectoral muscle. Access was thus given to the axilla, and the tumour was found to extend beneath the smaller pectoral muscle, and continuously upwards beneath the clavicle. From the close connection in which it was held to the coracoid process and clavicle by the fascia in that region, considerable difficulty was found in detaching it from the subclavian vessels and nerves, the fascia requiring cautious division with the point of the knife, as the adhesions and relations refused to yield to traction. After this separation the supra-clavicular portion of the tumour was drawn down, and the mass, weighing eleven ounces, was removed entire. One artery required a ligature. The patient made a slow recovery, having diffuse cellulitis in the neighbourhood of the wound and, subsequently, threatening of pyæmia, but she ultimately returned home quite well. The only doubt which was at first felt was, whether the case might be one of chronic abscess; but this suggestion was soon dismissed as untenable. The interference with the functions of the arm, as well as the pain, rendered the operation necessary.

The largest tumour of this kind that I have removed, was from the front and inner part of the thigh. It weighed

several pounds; and in its removal the sheath of the femoral vessels was exposed for a considerable distance.

Enchondroma of pelvis.—A middle-aged woman was the subject of this disease. She was able to give but little account of herself, except that, when she came under my care, she had been afflicted for three years with a tumour above the hip: that its growth was gradual, and increasingly affected her power to walk and her health. The tumour evidently originated from the bone; it was limited to the left side, and could be traced, from the exterior of the pelvis, over the crest of the ilium to its interior, where it evidently encroached on the contained viscera. The patient was anæmatus, and lacking appetite and sleep.

I conjectured that the disease was medullary cancer of the bone, but the result showed that I was mistaken. She survived for a considerable time in the hospital, but at last sank rather rapidly. The tumour was entirely confined to the bone, and involved nearly the whole of the os innominatum. The crest of the ilium and some portions of the ischium were the only parts which retained their original structure. The growth was projecting on all sides, and formed a solid tumour of eight and a half inches in diameter, vertically, and nine inches horizontally. On making a section it was found to be enchondroma. The microscopic appearances were those of cartilage. The rectum, vagina and bladder were displaced, and the pelvis of each kidney was dilated, consequently on the compression of the bladder. The uterus was healthy. There were traces of recent pericarditis, which probably hastened death, though there were no symptoms to attract attention during life.

*Adenocoele, with milk-cyst.*¹—A young married woman, æt. 24, was admitted under my care in 1874, with a large tumour of the left breast. She said that she first noticed a swelling at the lower part of the breast eight months previously, when it was about the size of an egg. Since that time it gradually increased in size, but had never caused her any pain, until during the last month she complained of a shooting pain

¹ This case is fully reported, with figures of the tumour and of its structure, in the 'Med.-Chir. Trans.' for 1873.

below the nipple. She had been married two years, and was, up to the time of her admission, suckling an infant, seven months old. The enlarged breast measured twenty-six and a half inches in circumference, the nipple being at the upper part six inches from the chest wall. It was uniform, globular, without fluctuation, and felt doughy, like the normal breast during lactation; the cutaneous veins were enormously distended. The great weight was sustained by the patient's left hand. In removing the tumour the breast proper was found to be unaffected, therefore the greater part of it was left. The only drawback in her recovery was the formation of an abscess which required opening. The hæmorrhage during the operation was troublesome, but not alarming. This large spheroidal tumour, the growth of which commenced, apparently, from the outer side of the breast, weighed eleven pounds, and was found, when cut into from behind, to consist of an enormous milk-cyst, or galactocoele, surrounded by succulent solid walls, on which were milk tubes, and an extra cyst. The walls were of varying thickness, but along the line of section they presented an average density exceeding an inch, and at some parts were two inches thick. The structure of the walls resembled the texture of healthy breast, with interspersed connective tissue; but it was more succulent, and milk exuded from the open orifices of divided milk tubes. A small cyst, containing firm cheese, projected into the larger. The contained milk of the large cyst, about two pints, was like fresh cream, and was composed, according to Dr. Bernays, of the constituents of ordinary cream, with a larger proportion of albumen than usual. There was a continuity between the breast tissue and new growth; but it was very slight, and required care to trace it. The succulent tissue of the walls of the large cyst was shown, under the microscope, to consist of acinous gland tissue, with an abundance of connective tissue. In the gland tissue there were blood-vessels and ducts.

A twelvemonth after the operation I heard that my patient had been confined; and she wrote to say that her affected breast was painful and full for the first three or four days, but soon ceased to cause her inconvenience.

SOME REMARKS
ON THE
CULTIVATION OF THE FACULTY OF
OBSERVATION,
IN PROFESSIONAL WORK.¹

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Introduction. The senses, their employment and education. Perception and Reflection. Method in observing. Self-reliance. Reading. Objective and subjective evidence. Consistency of signs and symptoms with each other. Symmetrical examination in disease or injury. Effects of treatment. Reasoning on things observed. Books and their use. Conclusion.

THE ability to make a correct diagnosis in disease or injury depends on experience obtained from personal observation. The experience derived from the observation of others is of comparatively little value: we cannot observe with other people's senses. It may seem paradoxical to say that there may be a form of experience without intelligent observation; yet such, in a certain sense, is the case. I have known men whose opportunities of seeing and of treating disease have been far beyond the average, yet upon whose opinion I should place very little reliance, because they have failed to improve their opportunities by cultivating the habit of thoughtful observation, and have neglected to record and classify facts which are brought under their notice in daily practice. I

¹ Read before the Physical Society of the Hospital, Oct. 18, 1888.

have also known some very advanced students—and when do we cease to be such?—who seem to be incapable of appreciating original observation, and who, when anything which is new to them is pointed out, enquire whence it was indirectly derived. Others, again, are always making discoveries, conceiving that what they learn, by observation, for the first time must be new. The latter class are far more hopeful than the former. They evince a power of observation, which requires discipline, culture and modesty, to render it effective and valuable. We often see a similar contrasted tendency in practice; some young men being devoid alike of resource and of confidence in their treatment of disease: whereas others, in an overweening reliance on physic, are constantly experimenting and making imaginary discoveries; treating the organic laboratory as if it were a chemist's dispensary, bound to obey all the laws of the inorganic world, and to respond to their ideas of the way in which each ingredient in their prescriptions ought to behave. They begin at the wrong end, failing to observe the potential influence of vitality on all such meddling, and ignoring the benignant tendency of nature in the relief of disease, and in counteracting the too often mischievous interference with her operations. In each extreme the result may be traced to the same cause, defective or ill-trained observation.

I remember a remark of Mr. Travers, when I was his pupil, which sank into my mind, as pithy sayings will do in youth, when the mental wax is soft and impressionable. I was telling him of something which I thought to be new and, no doubt, correspondingly important. His rebuke was a gentle one. "You will find," he said, "many old dishes served up under new covers." My experience has certainly verified this prediction, especially since the variation and complication of names has rendered modern nomenclature somewhat perplexing to older pathologists. At least I have found it so. It is not infrequently difficult to recognise old friends when introduced under new names. Nevertheless, these re-discoveries, if they are real and not imaginary, are among the most valuable of the stores laid by for future use. They are not borrowed, but realised property, the value of which is appreciated, and which will not be wasted or lost.

It is unnecessary to remind you that we obtain all our knowledge of the world around us through the medium of our senses; and upon their education much of our future usefulness depends. In animals the relative development of the different senses is determined by their habits and requirements; and sight, hearing and scent, severally, attain a degree of perfection in different species, as in the eagle, the deer and the blood-hound, far exceeding that in the human race. But the range of man's senses is much more expanded than that of other animals, in, for example, the appreciation of form, colour and beauty by the eye, of melody and harmony by the ear, and of various odours and tastes: The delicacy of the sense of touch in the tips of the fingers is also a natural endowment of great value; whilst the capacity of the sense of taste is largely called into requisition and appreciated by the educated palate of the epicure.

It is said, and I believe with perfect correctness, that the senses of sight and hearing are much more acute in the savage than in the civilised man. This, no doubt, is partly due to inheritance; but more especially so to education. This delicacy of sensuous perception is rendered necessary for them, as for animals, by their environment, to enable them to survive amid the difficulties and dangers which surround them: it is by observation that they acquire that accuracy in seeing and hearing on which their lives so much depend.

This acknowledged acuteness of the senses in savages induced a French physiologist recently to institute a series of experiments on criminals, with the view of ascertaining whether this class, from their alliance in point of civilisation to savages, is not similarly endowed with quickness of sensuous perception. A negative result demonstrated, as might have been expected, the fallacy of the suggested analogy: for, in the case of criminals, necessity does not compel the cultivation of special senses, and the influence of heredity is absent. Ingenuity and dexterity in planning and executing his designs is often displayed by the practised criminal; but, in civilised life, nervous sensibility and delicacy of sensuous perception seem to be generally commensurate in degree with culture and refinement. It is sufficient to allude

to the well-known fact that privation of one sense, as in the deaf-mute and the blind, tends to sharpen other senses which are used vicariously of them : and this is specially exemplified in those deprived of sight, of whose delicacy of touch many remarkable instances are recorded. I mention these things to prove how much may be done for the senses, those inlets of knowledge, by education, under the imperious demand of necessity.

The training of the senses may be illustrated by a few examples. First of sight. It is by the Eye that we observe variations in colour, form and size. The presence or absence of symmetry is thus detected ; but, beyond all, we are often enabled to form an accurate opinion of the condition of a patient by his aspect and expression of countenance. The medical man should be a physiognomist ; and if he be observant he can scarcely fail to become one. How much does the expression of the eye alone convey to the intelligent observer of the condition of his patient. The glittering but delusive gleam of consumption ; the eager and restless glance of approaching delirium ; the furtive look of the malingerer ;—each tells its tale to the expert, though unnoticed or misinterpreted by others. The complexion characterises many diseases, as jaundice, ague and hectic ; but all need study to associate them with the morbid conditions with which they are allied.

The Ear is most valuable to the physician, but not without its uses to the surgeon. I need only allude to the information acquired by auscultation and percussion in diseases of the lungs and heart, for this part of my subject to be readily understood : for regular and systematic training, by observation, can alone qualify even the most gifted to form a just and accurate diagnosis in diseases of the chest. In surgery, the presence of stone or a distended bladder, the seat of internal strangulation or the condition and contents of a hernial sac ; the presence of aneurism ; the crepitus of fracture,—are all aided by the ear, which is trained by repeated observation.

But still more is the practised sense of Touch of essential value to the surgeon. The instances I have just mentioned, with numberless others, exemplify the importance of educating

the hand. I will cite only two illustrations. How much is learned, involving even life and death, of the impulse of the heart's action and the condition of the circulation, by simply placing the finger on the radial artery. Yet how long, how careful, and how thoughtful must be the training to elicit the full value of this simple act.

Again, the surgeon rarely passes a day, without being required to form an opinion on the nature of some morbid swelling, which is outside the range of any other sense. Is the tumour fluid or is it solid; is it fat or some malignant growth; is it aneurism, abscess or cyst; is it fixed or free? I know of few manual acts that demand longer and more careful training than the detection of deep-seated fluctuation; and there are also few conditions on which so much in diagnosis depends. Indeed I regard skill in this respect as no mean test of educated manipulation; and its difficulty is proved by the difference of opinion which is often expressed in the diagnosis of an obscure case, even by experienced surgeons.

It is needless to speak of the senses of Smell and Taste: they are less important, yet should not be neglected; for there are many ways in which they may be employed; *e. g.* peculiar odours are associated with some diseases; and the insanitary condition of a sick room may be detected by the foulness of its atmosphere.

But the question is, how are the senses to be educated? I can answer this enquiry negatively, but it is not so easy to give a positive reply except in very general terms. They certainly cannot be trained by the student sitting at home, and pretending to learn his practical work from books. Neither can he educate them by simply watching others when engaged at the bedside of the patient. In one word, he must be self-taught. Certainly the clinical teacher may help him by directing him what to look for, and by correcting him when wrong: but he must depend for his training on his own observation. A disciplined use of the senses cannot be communicated from one to another; it is a purely personal acquirement, for the neglect of which no amount of book-learning can compensate.

There are now many adjuncts to aid the observer in the

use of his senses, which did not exist when I was a student. Indeed most of them—the laryngoscope, the ophthalmoscope, the endoscope and the sphygmograph and clinical thermometer are of comparatively recent introduction. When I began the stethoscope was just introduced; and a cumbrous instrument it was that I carried when I was clinical clerk to Drs. Elliotson and Roots. It is needless to remark that its extraordinary utility has fully justified the sanguine expectation of the great physician who first used it.

I would say one word in favour of another mechanical aid in observing, and that is the art of delineating what is seen. This power, when it exists, is valuable in developing the faculty of observation; for it requires accurate attention to make a truthful drawing or diagram; and when made it is an enduring memorial of what has been seen and critically scrutinised. Many members of our present staff exemplify these remarks, notably Dr. Bristowe and Mr. Anderson, as well as others. All who knew Mr. Stewart will remember how admirably he illustrated his lectures with his pencil. I would say, then, to all who possess any taste for drawing,—cultivate this art sedulously, and use it in the way I have suggested.

There are many qualities which a carefully disciplined habit of observation tends to develop. Our knowledge, as I have remarked, is first acquired by *Perception*, but it is utilised and rendered fruitful by *Reflection*.

In observing the natural character of individuals, we may notice that, generally one or other of these qualities predominates; but it is the possession of both in a rare degree that constitutes the characteristic of the more highly gifted. A quick perception is a great charm in those with whom we hold intercourse; but it may be a snare to its possessor unless balanced and steadied by reflection.

These mental characteristics are fed by observation, and the activity of their employment has great influence in determining the practical qualifications of the medical man. By this I mean that the faculty of perception may be well developed, but it requires voluntary attention for its exercise. Again, there may be quick perception and ready appropriation of whatever is presented for observation; but if knowledge

thus acquired be simply stored in the memory, without reflection on its relation to other knowledge previously possessed, it loses much of its value, and is comparatively fruitless. Such mechanical accumulation of facts may serve to supply precedents in daily practice, but nothing further. I shall have a few more words to say on this subject before I conclude.

If these faculties are to be nourished by observation there must be method in observing. It is well to be alive to all that is going on around us, but we must guard against the distraction of the attention from that which, at the moment, most imperatively demands it. Desultory attention in observing, and wandering thoughts in reflection, are alike pernicious, and demand a vigorous control. It was not by indulging such erratic temptations that John Hunter or Darwin have left imperishable monuments behind them.

One of the most valuable results of methodical observation is self-reliance : and this, if well founded, is the sheet anchor of the medical practitioner in the daily exercise of his profession. Self-reliant in one sense he must be, whether he will or not : but if he neglect the means of justifying his confidence in his own resources, his practice can prove only a humiliating failure, and his life an unenviable record of error in diagnosis, and consequent ignominious helplessness in the treatment of disease.

Again, the advantage to be derived from reading is infinitely enhanced by personal observation. We are thereby enabled to verify the accuracy, or to correct errors and imperfections in the conclusions we may have drawn from what we have ourselves observed ; or, it may be, to catch the writer tripping in these respects ; for authors are mortal, and not all good observers ; and compilations are very apt to perpetuate errors in medicine as well as in history, where statements are copied without personal verification.

It should be remembered that method in observation includes the order in which things are to be observed. Thus, the study of physiology, or the healthy performance of function, must precede that of disease, as an acquaintance with anatomy is essential for the pursuit of pathology. For how can abnormalities of organs be advantageously studied

without a previous knowledge of their normal structure and functions, whereby a comparison may be instituted, and the deviations from a healthy standard determined?

Good books, properly used,—by which I mean as supplementary to clinical teaching—are valuable helps to the practical student; but there are many things which no book can teach. There are various complicated circumstances in cases which are continually brought under our notice, in which mere precedent will afford only an uncertain and partial help, and book knowledge alone is valueless. Take, as a familiar example, a bad compound fracture, in which you are required to determine whether a limb shall be sacrificed or an effort be made to save it. A decision is not to be arrived at from a simple contemplation of the local injury; but a number of collateral circumstances have to be investigated and weighed, which importantly bear upon the question. Such, *e. g.* are the age, the temperament, the habits, and the general health of the patient. The condition of the heart and lungs, and of the great vessels must be ascertained, as well as the state of the arteries generally as regards their elasticity or rigidity. Locally, the attention must not be confined to the bone, but must be directed also to the amount of contusion or laceration of the soft parts, and especially of the blood-vessels and nerves. How it is possible for all these circumstances to be properly considered, and to have their due import attached to them by a book-learner,—by one who has not stored up the fruits of observation, when such cases were brought under his notice during his hospital studies? In medicine it is so likewise. Many a home student, who neglects the opportunities of clinical instruction, may write an admirable essay on pneumonia or pericarditis, and yet be utterly at a loss by the bedside. But enough has been said on this subject, and I turn to the consideration and illustration of the manner in which observation may be turned to the best account.

The association, separately or conjointly, of Signs and Symptoms—by which I mean that which is objective and that which is subjective—is an important element in the observation of disease, with a view to correct diagnosis. In some instances this alliance is very palpable, whereas in others it is

very obscure. Objective evidence includes all that can be brought under the direct cognisance of the senses: *e.g.* not only the deformity and crepitus of a fracture, but the condition of the pulse and tongue of the patient: and the value of this form of evidence is, of course, commensurate with the skill and experience of the observer. In some instances a single sign presented to a single sense is sufficient to determine the nature of a disease or injury: in others it may prove fallacious. I will take my illustrations from surgery. We will suppose two patients to be brought to the hospital who had fallen from a height. On stripping them, the leg of one is seen to be bent in the middle, forming an obtuse angle, over which the skin is tightly stretched. Further examination in this case is not needed: there must be a fracture of both bones of the leg to permit this deformity;—an inference which would be still more palpable, if the broken bone had penetrated the skin. In the other case the fallen shoulder and hollowed deltoid, with prominence of the acromion, at once suggest a dislocation of the humerus. But would it be safe, as in the other case, immediately to act upon this evidence? Assuredly not; for there are other injuries near to this joint, in which the deformity very much resembles that of dislocation; and careful examination is necessary before a trustworthy diagnosis is arrived at. I have known many mistakes made under these circumstances, detrimental alike to the patient and his medical attendant. Therefore, it is a good rule never to omit any means of testing the correctness of our diagnosis, in cases where there is the slightest room for doubt. I think such searching enquiry is the general practice of those who have most experience: and they are they whose observation has been most extended and intelligently critical. It is, then, upon the association of objective indications that the surgeon depends chiefly for his diagnosis; and it is by the carefully studied and repeatedly observed alliance of these signs that he is enabled to form an accurate estimate of their separate or associated value.

Thus far the perceptive faculty is specially called into activity; but supplementary evidence afforded by subjective symptoms taxes much more the reflective faculty. Objective evidence may be obtained without questioning a patient:

indeed, as a rule, it is better to exclude all interference on his part whilst we are collecting this form of evidence, and to depend entirely on our own observation. But for *subjective* symptoms we are compelled to depend on our patient in great measure; and in eliciting information great tact and an unprejudiced mind are required. Generally it is injudicious to ask leading questions where it can be avoided,—especially, though not exclusively, when the patient is uneducated: more trustworthy information is obtained by allowing or encouraging him to tell his story in his own way. The presence or absence of pain on pressure, *i. e.* tenderness, is an important ingredient in the diagnosis of many cases: and here it behoves the practitioner to be very observant of his patient's countenance and other indications by which he may distinguish between real and simulated suffering. Again, the genuineness or otherwise of subjective evidence, such as various sensations complained of, may be tested by noticing whether they are consistent with other evidence that has been already verified. Thus, the diagnosis that peritonitis is present, because complaint is made of acute pain on pressure over the abdomen, would be inconsistent with a cool skin and quiet pulse, and the notable circumstance that a light touch provokes more complaint than heavy pressure. Again, the presence of a soft and tender tumour in the groin, accompanied by sickness and other evidence of constitutional disturbance, might suggest strangulated hernia, but for the absence of other indications which forbid the conclusion. I remember being summoned to some distance to operate on such a case, which had been well manipulated in the effort at reduction; but the true nature of which I was soon able to demonstrate by opening a suppurating bubo. I can also recall instances in which extravasation of urine has been mistaken for orchitis or erysipelas of the scrotum. In one such case there was a large bag of mixed pus and urine in the perineum; in another gangrene had extended half way up to the umbilicus; and in neither case was the cause suspected. The practitioners who called me in were my seniors and have long since passed away. But what is the explanation of these fatal errors? The answer is, neglected or careless clinical observation.

In our study of disease or injury it behoves us to be mind-

ful of natural or acquired deformities, which, if not recognised, may prove a serious source of embarrassment. This does not occur frequently; but I have known it to happen sufficiently often to render it worthy of the attention of the practitioner.

There is one method to be followed, especially in observing surgical injuries, to which I am disposed to attach much value in making the necessary examination for forming a correct diagnosis. It is that of symmetrical observation, and with one sense at a time. I can best explain my meaning by an example. I will suppose I am dealing with an injury to the shoulder. I have my patient placed before me, and notice with the eye, both before and behind, the exact deviations from the normal condition observable in the limb that is injured. Next, in order to avoid the snare I have just spoken of, I enquire whether the two shoulders were previously alike, and whether, before the accident, the patient had free use of both arms. I then place myself behind him, closing or averting my eyes,—as the physician does in using the stethoscope—and put the forefinger of each hand upon the corresponding sterno-clavicular articulation, and carry it slowly along the line of each clavicle, by which I am conducted to the acromion process. Thence the finger travels along the spine of each scapula, and its inner and lower angles are also explored. To the practised hand the slightest difference would be revealed; and if there be none, the seat of mischief is thus circumscribed. The joint is then examined in the same way, both by touch and sight, but by each separately, so that impressions may not be confused. A similar proceeding is equally available in other injuries of the limbs and trunk, where a symmetrical comparison can be made; and generally with much advantage, both as regards exactness, and the saving of time and inconvenience to the patient as well as the surgeon.

I will briefly notice but one more precaution to be taken in the examination of injuries: it is that of ascertaining how the accident happened, the direction of a fall, the soiled condition of the clothes, and especially what bruises or other indications of hurt may have been received. All these things should be carefully observed, as they may throw light on an obscure injury. These circumstances have generally an essen-

tial bearing on accidents to joints. In dislocation of the hip, the position of the limb at the time very much determines the direction in which the bone is displaced. In injury to the shoulder, if you find that the palm of the hand is soiled or grazed, or that there is any other indication that the patient fell with his arm outstretched, a dislocation of the head of the humerus may be suspected: whereas indications that the patient has fallen on the shoulder would suggest fracture as the more probable cause of the deformity. Again, in injury to the head, the nature of the ground on which a patient has fallen, head downwards, may help us in forming our diagnosis as to the cause of prolonged insensibility; fracture of the vertex being more likely to occur on hard ground, and fracture of the base on a soft and yielding surface:—a point to which I directed attention in my lectures before the College of Surgeons.

It is needless to remark that the effects of treatment, whether in our own practice or in that of others, should be carefully observed: and this is a reason why treatment should be simple, and uncomplicated by the admixture of various ingredients. In surgery this remark applies especially to the management of operations, and the dressing of wounds. In such cases I am disposed to place very little confidence in adventitious aids, and to rely on perfect cleanliness, and absolute physical, and as much physiological rest as can be obtained, consistently with such requirements as may be demanded in special cases. In medicine it is, possibly, more difficult to adhere to this rule of simplicity: yet one can scarcely wonder that our list of specifics has been so long almost stationary, and that the most diligent observer is so constantly thwarted in his research, when the complicated style of prescribing, so commonly in vogue, is considered. But I feel I am travelling wide of my subject, and that I should apologise to my medical brethren for this remark: yet I cannot but wish that, for the sake of therapeutics, prescriptions contained fewer ingredients than they usually do in private practice. It is, of course, difficult, if not impossible, for the observer to unravel the mystery of some of these compounds, and he must be content to accept the dictum of the prescriber. In noticing the effects of treatment in which the

means employed are necessarily complicated, a careless observer is very apt to attribute consequences to wrong causes;—an error which, in heroic hands, is not infrequently fraught with much mischief.

I have said a good deal on the subject of how to observe and what to observe: but the question remains to be answered, whether observation, even when studiously cultivated and well directed, is alone sufficient to make the experienced and trustworthy physician or surgeon. Hear what Frank Buckland says respecting himself when past 40 years of age. "I thank God the Dean (his father) gave me a good soil at Oxford, which will grow almost any seed placed in it, and I must now plant a new seed. Those of observation have grown into big trees long ago; I must now plant the tree of mental reasoning upon things observed." ('Biog.,' p. 224.) It may be doubted whether, in this implied self-censure, Buckland did himself justice,—whether, indeed, his modesty did not betray him into doing himself a grave injustice. Nevertheless his words embody an important lesson; for observation, without reasoning on the things observed, is like collecting plants without arranging or classifying them; like accumulating the materials for a building without putting them together. Bare observation of facts, as I have already remarked, may serve to guide the man of precedent; but, without the exercise of reasoning on those facts, it cannot raise him into the higher region of justifiable self-reliance in his daily practice: for such is the attainment only of the man who has fixed principles to guide him. It cannot, therefore, be too strongly or too early impressed on the student that reasoning must accompany observation. I do not mean that he should be encouraged to generalise upon limited data: this would be avoiding one evil to fall into another:

" Incidit in Scyllam qui vult vitare Charybdin."

But he should be taught the value of enquiring into the causes of what he sees, and of cultivating the habit of classifying the results of his observation, with a view to their future utilisation, as he raises the superstructure of his edifice. Unhappily, as I venture to think, this does not seem to be the line pursued in modern education, the special aim of

which appears to be the ingestion of as many facts as possible, with but little reference to their classification or even their permanent retention. Mental peptone is supplied irrationally in the form of knowledge-made-easy books; and the consequence is a loss of appetite for, and enfeebled power of digesting, plain and wholesome food.

The practical manuals for the use of students in the present day seem to me calculated to discourage personal observation, by supplying details, to be committed to memory, instead of being sought and observed. The so-called "systems" of surgery are a comparatively modern innovation. When I was a student we had Cooper's 'Surgical Dictionary,' which was used for reference; but we had to seek for written information on subjects which interested us in monographs, which had all the freshness of original observation:—mental pictures which infinitely transcend in value the much-abused and often mischievous substitute of pictorial illustration. I would say to student and young practitioner alike, take as your guides such books as, from their suggestive style encourage or compel you to learn by observing for yourselves: and beware of attempting to learn either anatomy or surgery from pictures. Yet I would not be misunderstood as depreciating the many excellent and exhaustive systematic works on medicine and surgery, which have been published in late years. I desire simply to condemn the abuse of them: and in this I think I should have the concurrence of their authors. They are a snare to the student who is tempted to "get up" his practical work by them alone: whereas they should be used rather as works of reference, and be read only as ancillary to clinical work, whereby the learner may be guided in his studies by the experience of qualified teachers.

I am aware I have but touched the fringe of a large subject, on which a volume might easily be written. And I have ventured on the privilege of the aged to be sententious, and to lay down rules for the guidance of my younger brethren, which they may think, if not irrelevant, at least superfluous. I would now crave your indulgence for one concluding word.

The value of observing depends on its accuracy. A loose or inaccurate observation is often mischievous because mis-

leading ; whereas accuracy tends to the development of that which is trustworthy and true : and the quest of truth is, or should be, the great purpose and aim of all scientific research. In cultivating this habit of accuracy in observing, we should especially beware of allowing ourselves to draw conclusions without having sufficiently tested the value of our data, or by mistaking the *post hoc* for the *propter hoc*. At the same time it should be remembered that there is a risk of falling into an opposite extreme. Scientific scepticism is admissible, indeed in a proper sense essential, in the investigation of Truth ; but it should be tempered by a reasonable reliance on accepted facts and the testimony of trustworthy witnesses.

There is yet another phase of scepticism against which the earnest student needs to be guarded : it is that of rejecting what he cannot understand, simply because it is unintelligible to him. There is scope for faith—the evidence of things not seen—in Science as well as in Religion ; but in each it has its limit. Faith, uncontrolled by reason, is apt to degenerate into ignorant credulity and superstition ; and scepticism, by indulgence, becomes arrogant presumption : and each extreme is destructive of that evenly balanced state of mind, alike receptive and critical, which is best adapted for scientific research and the apprehension of Truth.

N.B.—For some remarks on note-taking, as an important aid to observation, the reader is referred to p. 57.

SOME REMARKS
ON THE
FACULTY OF ASSOCIATION,
ESPECIALLY IN RELATION TO PROFESSIONAL
STUDIES.¹

Definition.—Classification.—Influence of education and habits.—Sympathy.—Popular fallacies.—Power of the faculty in animals.—Memory.—Imagination.—Influence of association on the emotions: in art: in diagnosis, prognosis and treatment: in physiology and general science.—Its cultivation.

It may be remembered that, last year, I made some remarks on "The Cultivation of the Faculty of Observation in Professional Work," in a paper which I read before this Society; and I now propose to supplement what I then said by directing attention to the agency of another faculty, that of Association, in mental training, especially in scientific studies.

It is a trite observation that success in any walk of life depends very much on early intellectual training. It is for this reason that preliminary education is now insisted on—and justly so—before the special subjects of professional study are taken up by our young men, just as physical training is essential for success in any bodily exercise requiring strength, activity and endurance. I will not, therefore, apologise for occupying your attention in speaking generally on the subject I have chosen, before applying my remarks

¹ Read before the Physical Society of St. Thomas's Hospital, 1889.

specially to professional work. I may say, indeed, that my purpose is not to instruct, but to awaken a fresh interest in the daily routine of your studies.

Let me first of all define the meaning I attach to the word "Association," as a mental attribute or faculty. I can, perhaps, best express the sense in which I use the word by saying, that it is an appreciation of the relation which facts or ideas bear to each other. Thus Association is begotten of Memory and Imagination; for without their co-operation it could have no existence. The most retentive memory, in the absence of imagination, is unproductive; and imagination, without memory, is either sterile, or its fruit is fantastic and unreal. The definition I have given is, perhaps, not a strictly philosophical one; but it has the advantage of simplicity and of serving my purpose.

The alliance which constitutes Association is sometimes obvious, sometimes obscure; in some instances real, in others fallacious. The ability to distinguish between true and delusive associations is a very important ingredient in all pursuits, but especially so in scientific studies. And I may here remark that it is not my intention to exclude from consideration such associated circumstances as stand in the relation to each other of cause and effect. We may, for convenience, class associations under three heads; 1, those which are both just and intelligible; 2, those which, though just and obvious, do not, with our present knowledge, admit of explanation; 3, those which are accidental and fallacious. Many are, of course, doubtful; and it is on the ability to solve these that a correct diagnosis in disease so much depends; and this ability, in turn, is the fruit of accurate observation and experience. Let me endeavour to exemplify what I have just said. All associations which stand in obvious relation to each other as cause and effect exemplify the first class, or those which are intelligible: such are the ordinary sequences of inflammation, the communication of infectious diseases, and the like. As examples of other associations, the presence of which we cannot explain but must admit, such instances may be cited as hæmatoma auris with insanity, cynanche parotidea with swollen and tender mamma. Many of these are called sympathetic as a cover for our ignorance;

such as sickness from a blow on the head, or bodily pain from mental emotion. As regards associations which are delusive, in that they usurp a relationship to which they are not entitled, their name is legion: they abound among the ignorant, and are not wanting in the educated, where there has been no scientific training to correct the inherent tendency, even in logical minds, to confuse the "*cum hoc*" or the "*post hoc*" with the "*propter hoc*." Such fallacies are the source of superstitions, which are yielding gradually to the extension of knowledge; and must recede still more rapidly before the impetus which has been given of late years to the study of natural science in our universities and schools.

As thoughts often succeed each other without any effort of the will, the influence of Association by which they are guided is very much determined by education and habits. The same symptoms may thus suggest a different train of thought to the Physician and to the Surgeon. It is in virtue of this association that the value of isolated signs or symptoms is enhanced, by the exercise of the will in recalling other instances in which a sufficient resemblance exists to justify their association. Although, as I have said, the associative faculty often exerts its sway spontaneously, yet we have the power to voluntarily retrace the path, step by step, by which we reached the distant goal. It is often interesting and amusing to do so, and our wonder is excited by the singular medley of links of which the chain of our associations is constructed.

There are few words which have a more comprehensive and suggestive meaning than Association: comprehensive, because of the influence—so often unbidden—which it exercises over our affections and emotions, our thoughts and intellectual habits, and on all our engagements in life: suggestive because we owe to it so much of our knowledge, especially in science. A thought, a word, the most trivial object of sense, each is capable of lighting up a train of association, by which scenes, individuals and actions are recalled without an effort of the will;—now delighting the imagination, now feeding reflection, or, perchance, awakening the sad or happy memories of bygone days. The various combinations to which we owe the harmony of music, the utterance of speech,

the enjoyment of reading, are all commonplace but no less marvellous examples of the habit of mental association, and of the permanance of its prevailing influence and power.

Though sympathy implies association the converse is not necessarily true ; for association may exist without sympathy. The secretion of milk after parturition demonstrates sympathy between the mamma and uterus : but we may often trace consequences, which have no necessary alliance except in the circumstance of their being due to a cause common to both, such as hydrocephalus and rickets, or caries of the foot and suppurating cervical glands, which are, severally, the expressions of a scrofulous diathesis. So, likewise, the active vigour and earnest hopefulness in which you rejoice, and the various infirmities of which I am sensible, are attributable to your youth and to my senility, to which they are respectively due. In many instances we can detect no alliance between co-existing phenomena ; yet their very co-existence constitutes a stimulus to investigation, in the hope of bringing to light some latent relation which may lead onward in the path of discovery.

As Association plays an important part in our joys and sorrows, so also much of our knowledge of character in intercourse with the world is acquired from the same source ; and memory is greatly beholden to it. The possession of this faculty also entails much responsibility ; for it may be controlled by the will ; and on the exercise of this control, in giving an elevating or degrading direction to our thoughts, does our moral condition very much depend.

The valuable fruit which the associative faculty is capable of bearing in the enlightened and educated has not saved it from abuse by the ignorant and prejudiced. Popular fallacies of every description are, as I have remarked, founded on the association of circumstances or occurrences, which have no relation to each other save that which is accidental or coincident ; yet they are credited with the relationship of cause and effect. The love of the marvellous fosters this habit ; and nothing then is too absurd to be accepted, if any association can be shown to exist which offers the most slender basis on which to build a conclusion. Many of these superstitions are purely local, and either entirely unmeaning,

or they have their origin in some accidental coincidence which impressed the vulgar mind. In the village in which I reside, it is a common saying that the boy who takes a robin's nest will break his arm ; and again, if the church clock strike whilst the psalm before the sermon is being sung, there will be a death in the parish during the week. Other superstitions are more diffused, and pretend to some foundation ; such as sitting down to dinner with thirteen at table, or the sailor's objection to commencing a voyage on Friday ; both of which are, probably, associated with Scripture history. Until recently I believed, in common with most people, that the phases of the moon and the weather had a relation to each other : but careful and prolonged meteorological observation, in competent hands, has proved that this assumed relation is fallacious.

This prevailing faculty of association is not confined to man, but is largely shared by the lower animals. Indeed, a due degree of importance has not been assigned to the power of associating ideas which they possess in common with man. It seems to be the foundation of their reasoning ; the faculty from which most of their knowledge, which cannot be referred to instinct, is derived. It is on an appeal to its active influence that the training of domestic animals chiefly depends.

This faculty in animals is often called reason, which indeed it is, in the sense that their actions are determined by the inferences they draw from observation. But I think, in general if not always, that these instances of reasoning power are resolvable into the simple association of the two elements of time and place, or to an appeal to some of the senses, and consequent action thereon. Thus, I have a stable cat which is troublesome in the garden, and was therefore consigned to a dark shed during the day. But puss did not approve of this, and let himself out. How this was accomplished we could not discover until he was watched, and it was found that he climbed on to a shelf where he could reach the latch with which the door was fastened, by pressing down which he released himself. This looks like a complicated process of reasoning which led up to the act : but I apprehend it was nothing more than the accidental discovery

that pressure on the latch liberated him ; and the subsequent association of this act with his freedom induced a repetition of the experiment. A similar instance was recently narrated to me by a lady, who vouched for its authenticity. A pet cat slept in a room with her master and mistress, who lived in a thatched cottage. One night the cat awakened her mistress by pawing her face, and she aroused her husband to see what ailed the animal. The result was that they found their room was on fire, and that they owed their lives to their pet, who, said my informant, declined to save herself by the open window until she had warned her protectors of their danger. This is a natural, but I think a fallacious conclusion. The cat was probably sensible of discomfort from the presence of the smoke ; and sought relief by thus appealing to those on whom she had been accustomed to depend. I need scarcely add that the narrator repudiated this explanation, on the cat's behalf, with some indignation. A very remarkable exemplification of the influence of association in animals, and of the ability to draw a just conclusion therefrom, is narrated, if I remember rightly, in the periodical entitled 'Knowledge.' The owner of an intelligent dog was accustomed to fish for eels in a pond ; and for that purpose fixed two or three rods in the ground, and watched the floats, attending to the lines when the disappearance of a float indicated that a fish was hooked. On one occasion the dog, who was his usual companion, barked violently to attract his master's attention ; but failing to do so he seized the rod between his teeth and drew an eel to the bank. Now, in this instance, the dog must have noticed the association between the disappearance of the float and the capture of a fish, and reasonably concluded that the two circumstances were related, and acted upon this conclusion.

The influence of the association of time and place is also well exemplified by animal sagacity. The famished birds, which my family had been in the habit of feeding after breakfast during the hard weather, would assemble at the same spot and at precisely the same hour for their accustomed meal. Horses will, in like manner, draw up at any house at which they have been in the habit of stopping. A remarkable instance of this occurred in the town near which I

reside. A tradesman changed his servant, whose business it was to drive round a populous neighbourhood to collect orders. When the new man came he naturally asked for a list of the houses at which he was to call, and was told by his master that he need not trouble himself, but trust to his horse to take him the accustomed round, and to stop wherever his services were required.

A very remarkable and well-authenticated instance of canine intelligence was recently recorded, in which we find the concerted action of three animals, and manifestation of reasoning power, which I am unable to explain on the principles employed in the interpretation of the other cases. On a certain Sunday morning in July, 1887, the porter of King's College Hospital heard a dog barking at the front door and went to drive him away. On the top of the steps he found two fox-terriers standing, and a collie lying beside them sorely wounded in the foreleg and bleeding. As soon as the door was opened the terriers decamped. A medical student, who chanced to come in, attended to the animal, arresting the bleeding and binding up the wounded limb. The dog rested on the grass for a couple of hours, and then departed. He was the property of a drover, who frequently passed the hospital; and his terrier friends lived hard by. I do not pretend to comment on this singular narrative without further acquaintance with antecedent facts, of which none seem to be known. The conjecture of the narrator is that the dogs had been in the habit of meeting, and that the terriers had constantly seen patients carried into the hospital. But even admitting these conjectures as facts, there are many links still wanting before we can explain the consecutive reasoning of the animals regarding the associations which appealed to them. How could they know that the building is a hospital, and that the applicants were patients; and how did they make known to their wounded companion what they intended by taking him there? It is a touching narrative, and conveys a moral lesson which he who runs may read.

It will be observed how important a part Memory plays in these mental acts. But Imagination is also requisite. Another cat story, for the authenticity of which I can vouch,

exemplifies this. The servants of a family in the country were annoyed by runaway rings, at their garden bell, which summoned them from their work across an intervening courtyard. They suspected that this was commonly the act of mischievous boys : but at length puss was found to be an arch offender. He was able, on his return home from his frequent wanderings, to climb the garden wall, but could not gain an entrance to the house : and he was observed sitting on the wall, where he had access to the bell-wire, which he pulled ; and whilst the servant was opening the gate he slid down unperceived, crossed the yard and entered the house. In this case Memory played a subordinate part, whereas Imagination was a more active ingredient in the association which led to this result. It is evident that the cat must have perceived the connection between the bell-ringing and the opening of the door. But it was not the outer gate that he wanted to be opened, but the house-door, and he had the sagacity to elude notice, and to escape into the house before the servant returned. In this way was explained the apparent mystery of there being no one within sight when the gate was opened.

When I speak of Imagination, of course I do not mean the exercise of the mind in that which is unreal fundamentally or in fact ; but that mental attribute by which new combinations are formed out of pre-existing materials. As I have already observed this faculty may become riotous if not under proper control, just as Memory sinks into apathy without Imagination to animate it. You will thus perceive that the one requires stimulating and fortifying, and the other restraint. A lady of my acquaintance firmly believed that she could remember things which occurred before her birth. I think this is a not infrequent belief ; and the explanation is, that certain events, occurring at certain localities, have been so often and circumstantially recited in our hearing, and imagination has portrayed them so graphically, that we associate the various elements which compose the picture, until we believe ourselves to have been actors in the scene. On the other hand memory requires not only to be inspired by imagination, but to be invigorated by careful training, otherwise this important ingredient in Association will not only

fail to gain in strength, but will lose much of its natural power. That a retentive memory is a gift there can be no doubt: but there can be as little hesitation in affirming that, perhaps more than any other gift, it can be vastly improved by practice, especially in the young. Our daily and hourly experience demonstrates to us how much memory is beholden to association, in thought, circumstance, time and place, which imagination supplies,—sometimes unbidden, at others sought for. Whatever may be the subject of study, the aid of association is constantly invited to render permanent the knowledge we acquire and wish to retain. Without it, the orator, the actor, the preacher would find their tasks irksome to themselves and unprofitable to their hearers. Nevertheless in some relatively rare instances, memory manifests an independence of association, which is suggestive of some *quasi*-photographic impression on the brain. A remarkable example of this endowment was narrated to me, many years ago, respecting the late Lord Macaulay, by a lady in whose library the circumstance occurred. A party was awaiting the announcement of dinner, when someone remarked on Macaulay's singularly retentive memory, and begged for an illustration of it. The historian good-naturedly acquiesced, and a volume on some subject with which he was unacquainted was handed to him. He read off two pages and returned the book to one of the company, before whom he repeated, verbatim, what he had just read. It may be reasonably supposed that knowledge so easily acquired is evanescent: indeed I have been told so by one who possesses this gift in a striking degree. The value of association in committing anything to memory may be tested by the effort that is required to retain a medley of sentences which have no relation to each other; such, for example, as the story told of Foote, a humorous writer, and which I remember more than fifty years ago, but had not seen till it was recently reproduced as an advertisement for Pears' soap. It was intended as a reproof to a boasting actor; and begins thus: "So she went into the garden to cut a cabbage leaf, to make an apple-pie; and at the same time a great she-bear, coming up the street, pops its head into the shop. 'What! No soap?' So he died and she very imprudently married the barber."

I may here say one word on artificial memory, by which I mean most of the aids to memory by artificial means. The expression is self-condemnatory, and such aid is generally the resource of the idle. The associations on which such acts of memory are founded are usually as trivial and artificial as their outcome. The instances in which the zealous student would resort to them are few, and justifiable only where the knowledge thereby acquired is devoid of practical value. I can see no objection to tying a knot in your handkerchief, or to changing a ring from one finger to another: this may prove useful, if you happen to remember for what purpose it was done.

The power exercised by emotional association varies remarkably in different individuals, according to personal experience and temperament. There is naturally more scope for its activity as age advances, in the accumulated memories of the past. But we are all apt to exaggerate our early associations, whether they be agreeable or the reverse,—forgetting the troubles which accompanied those that we remember with pleasure, and more often ignoring the blessings which alleviated our past trials.

“A sorrow’s crowning sorrow is remembering happier things.”

But we can all control these exaggerated tendencies, if we are willing to keep our emotional associations under restraint. In dreams the emotions and imagination have uncontrolled sway, and the associated combinations are often a whimsical blend of improbabilities, a medley of past events without any natural alliance. Such, indeed, also is often the character of insanity: in both the control of the will over the associations is perverted or suspended.

The influence of the emotions in some diseases and in special temperaments is noteworthy, and deserving the medical man’s study. A cheerful manner, and the suggestion of agreeable associations, have often a striking effect in promoting a healthy tendency, and in some instances in even saving life. Of the truth of this remark some notable examples have been recorded; and I am satisfied, from observation, that hope or despair on the part of the patient is capable of exercising, in special circumstances, an influence which has,

humanly speaking, turned the scale between life and death. There may be a despairing wish to live ; but it is the hopeful effort that saves. Yet, let me not be misunderstood as commending the encouragement of hope where we know there is none : this I can regard as no less cruel than wrong. In the management of the insane these remedial characteristics exercise a marked influence for good. The suggestion of cheerful associations constitutes, or should constitute, an important factor in the treatment of most cases ; and especially so at the present time, when affections of the nervous system seem to be on the increase, in the fast age in which we live.

The association of facial expression with temperament and disposition is also worthy of the practitioner's thoughtful attention. He should be, as I have said elsewhere, a physiognomist. His treatment may be influenced by the information thus imparted.

A curious exemplification of the power of association is that of names with faces. The mention or sight of one suffices often to recall the other. Still more interesting is the dominion it exercises through the medium of the senses. How few of us there are who have not experienced the gentle but irresistible sway by which association thus subjects us to its syren will. The bird's song, the murmuring stream, the scent of a flower, suffice to arouse memories of the past, reviving, it may be, sorrows long since laid to rest, or soothing those that are still fresh ; more often, I trust, with you, my young friends, recalling happy moments, which are still further sweetened by a prospect of their renewal. Can you witness, unmoved, the budding green of early spring, with its hopeful promise, or the rich but more sombre tints of autumn, suggestive, as they are, of resignation to the coming winter ? Has the sea-shore no voice of association for you ? The dull thud of the breaking wave, and its rasping echo as it recedes on its pebbly bed, must surely remind you of your boyish pleasures on the shore ; and when you are old it may recall, as it does with me, the welcome periodic rest of mind and body, amid the excitement of a busy life.

Art, in all its phases, as illustrated by its master spirits, is abounding in associations, and no less do the time-worn relics of past ages bring back those eras in almost living

presence. What a crowd of associations will a flint implement or a fossil bone awaken in the antiquarian or geologist. Have you ever surveyed the site of an old Roman camping-ground, with its still defined vallum and fosse, without imagination portraying the bristling palisades, the cohorts and their centurions with their helmeted heads and short swords, and the stern sentinels on their sleepless watch at the portals? Or have you wandered through the ruins of an old baronial castle, or gazed in admiration at the crumbling ruins of a monastery or abbey, without a consciousness of the power of association in revivifying the scenes which have been enacted within their walls in the feudal times of early England? You may almost hear the tramp of the horsemen, or the chant of the monks, and see them file past you in spectral array.

These illustrations might be multiplied indefinitely; but association has a more serious claim on your attention and study than in the instances to which I have alluded; for it is by scrutinising and collating, if I may so express it, the various signs and symptoms which a disease presents, and by selecting those which experience has taught you may be fairly associated in the special circumstances of the case, that your diagnosis depends. I will presently endeavour to illustrate my meaning by some examples, as there are few incidents that engender fallacious ideas and conclusions more than loose associations in the investigation of disease.

But we must first have a clear understanding of the distinction—I admit it is in great measure conventional—between signs and symptoms. It is the same as that which obtains between objective and subjective evidence. A sign is objective because it is manifest to one or more of our senses; as colour, temperature, pulsation. Subjective evidence we are compelled to take on trust; such as pain, giddiness, nausea: and these are, strictly speaking, symptoms, the value of which is necessarily less positive than that of the objective class.¹

We will now glance hastily at the general signs and symptoms on which we so much rely for our diagnosis; such as the condition of the circulating and respiratory organs, of the skin, the tongue, and the excretory glands. If we contemplate the varying phases which these organs present under

¹ For further observations on this subject, see page 198.

different conditions, as well as the diversified associations of which they are capable, and the many inferences of which such relations are suggestive, we may form some idea of the educational requirements of the clinical practitioner : for it is scarcely needful to repeat my remark, that a correct appreciation of the relation which the several indications bear to each other is the basis on which a correct diagnosis is raised. In some instances all the essential indications are present, and the diagnosis, to those who know how to estimate their value, is simple : in other cases one or more may be absent, and the difficulty of arriving at a correct conclusion is augmented in proportion to the importance of the deficient symptoms or signs. The pulse and temperature may not be in accord : the tongue may not confirm the conjecture suggested by the condition of the assimilating organs. Then the question arises whether these inconsistencies are attributable to our own imperfect examination, or due to some intrinsic peculiarity in the patient or case, or to some other disturbing element which has escaped our notice. We must carefully analyse these apparent anomalies, and weigh their relative importance if we cannot explain them ; or we must await the further development of symptoms which may bring into accord the disturbing elements of the case. Where there is urgency we must be guided by our general knowledge of disease rather than by dependence on the light afforded by precedent, which often proves delusive in difficulties. Indeed, this dilemma affords an apt illustration of the insufficiency of precedent where the cultivation of sound principles is neglected. Unexpected complications and novel associations continually present themselves in dealing with disease, which demand a more comprehensive acquaintance with pathology than mere precedents in practice can supply.

Some of the most perplexing cases with which we have to deal are those which afford only subjective evidence, unsupported by any indications which can be brought to the test of observation. I have had considerable experience of this class, in dealing with railway injuries, the patients being tempted, by the prospect of gain, to exaggerate or feign suffering or incapacity. Hysteria also may commonly be placed in this category. Such cases as these, in which

association fails to help us, test the sagacity of the practitioner, but may generally be stripped of their disguise by carefully planned questions and physical examination, whereby the inconsistency of the patient's symptoms with each other, or with admittedly healthy conditions is demonstrated.

I will now select some special cases, exemplifying the value of associated evidence in diagnosis. Almost any disease or injury, except of the simplest nature, will answer this purpose. Take, for example, the eruptive fevers. They are usually ushered in by recognised symptoms,—rigor, quickened pulse, high temperature, and general disturbance of the system. But we must await the development of further indications before it is possible to determine the specific nature of the attack. It is by such further evolution of the case, and the association of other signs or symptoms with the febrile attack, that we are enabled to declare whether the case be one of scarlatina, measles, chicken-pock, &c. Let me briefly relate a case in point, which recently came under my observation and care. A young man came down from London to the neighbourhood of my home in Kent, to play in a cricket match. Whilst playing he suddenly became faint and sick, and had a rigor. I saw him two or three hours later, and found his throat swollen and inflamed so much as to impede both articulation and deglutition. The tonsils, palate and tongue were of a bright raspberry-red hue; the pulse was rapid, the temperature high, and there was severe headache. The alternative probabilities seemed to me to be scarlatina or acute tonsillitis; and it was not until after the lapse of twenty-four hours that the diphtheritic patches on the tonsils and palate, which speedily coalesced, declared the true nature of the attack. And this was followed by the general engorgement of the throat and prostration which are associated with the absorption of a large dose of this poison. Take again a case of acute osteitis in a long bone, which comes more under the surgeon's care. How difficult it often is to determine the cause of the patient's suffering at an early stage. We seek to associate with his symptoms some early history, some specific malady, some injury, which may throw light on the case; but often the obscurity continues until suppuration explains the severity of

the preceding suffering, which ushers in the tedious process of exfoliation of necrosed bone. But it is unnecessary to multiply these instances to demonstrate how much we are beholden to the association of signs and symptoms in the diagnosis and treatment of disease. In the management of infantile complaints the practitioner is more dependent on his sagacity in associating the objective manifestations of disease, than in those of patients who are able to help him by describing their subjective symptoms.

Again, how many elements there are demanding consideration in their mutual relations, which thus guide us in our prognosis, as in our treatment of disease and injury; such as previous history, health, age, temperament, habits, locality. An injury from which a healthy and temperate man, residing in the country, would readily recover, would probably prove fatal to the intemperate denizen of a populous town. We can regard neither the patient nor his disease in the abstract: we must associate the one with the other, and contemplate all the accidental concomitants which may affect them in their relations to each other.

The treatment of disease, especially by the use of drugs, necessarily tests the ability of the practitioner, by eliciting his acquaintance with the associated circumstances attending each case, and in the requisite combination of the ingredients of his prescription. How commonly neglect of these considerations renders treatment abortive: the rule of thumb is the resource of ignorance. Drugs are prescribed which neutralise each other. Elements are combined, and each is expected to fulfil its mission, without reference to their mutually repellent action, or to organic chemistry which confounds the wisdom of the prescriber. Much in therapeutics is still necessarily so empirical, that it scarcely excites wonder that the discovery of many remedies is due to the accidental notice of the association between the use of certain drugs and their effect. Indeed, I remember that it was the avowed practice of two learned physicians in our hospital, in my early days, to experiment in this way, with the view of ascertaining some new remedy, or, in other words, some novel association between a drug and the disease for which it was prescribed. Certainly this empiricism has been more

fruitful in the discovery of specifics as they are termed, than strictly scientific therapeutics. In this way the specific action of iodide of potassium was observed and made known to the profession by one of the physicians to whom I have just alluded.

Physiology affords an ample field for illustrating this subject, in the adaptation of structure to function and of function to environment ; such as light and sound in relation to the media by which they are produced ; and these again in their alliance with the special nerves of sense, and the beautiful arrangement of modifying apparatus by which the organs of sight and hearing are perfected. This is a chain of association, the severing of one link of which is fatal to the whole. If pain were not associated with physical injury we should lose our best protector. If hunger and thirst were not associated with the necessity for taking food and drink, we should neglect the duty of nourishing the body. But it is not any one science which is alone indebted to the pervading influence of associated facts and ideas. We cannot reason on any subject, deductively or inductively, without the suggestive help derived from this source : whether we proceed from the whole to the part, or ascend from the part to the whole, we must rely on the mutual relations of the constructive elements or data of our argument, to conduct us to our inference. And thus has it been in all great discoveries. Harvey was in this way guided in his demonstration of the circulation ; Jenner in his proof of the protective power of vaccine lymph ; Bell and Marshall Hall in their researches regarding the nervous system ; Owen in his reconstruction of an extinct animal from a single bone. Bacon, the earnest advocate if not the father of inductive reasoning, and Hunter and Darwin, his patient disciples and followers in the same slow but safe path of generalisation ; and Newton, greatest of all ;—each one pondered over and determined the true association of the constituent materials, with which they, severally, built up the monuments of their immortal fame.

Is this natural gift capable of cultivation and how, is a pertinent question, and I will endeavour to answer it in very few words. The most obvious method is that of scrutinising every association which is brought under our notice in the

course of study, with the view of ascertaining whether it is true or false, usual or accidental : this, indeed, is an essential part of our professional education. But beyond this I have found it both instructive and interesting to foster the habit of questioning any associated circumstances which present themselves in everyday life ;—the common things which one is apt to take for granted without seeking for an explanation. This may be done whilst you are sitting at home or walking abroad, in town or in country. For example, you know, when the steam is issuing from the spout of your kettle, that the water boils. Or you notice, when you awake in the morning, that there is a deposit of moisture on the inside of your windows, and you infer that the outside atmosphere is cold. The simple association of these conditions, respectively with each other, is commonly considered a sufficient explanation of them ; whereas it is no explanation at all. Follow out each of these relations till you have exhausted all that is known about the properties of steam and the condensation of vapour, and you will find ample food for reflection. It has been narrated of Watt when a boy, that in observing the action of steam in a tea-kettle, and reflecting on the association of the ebullition and the moving lid, he manifested the first germs of that mechanical genius which afterwards perfected the steam engine.

Again, when you are in the country, you know that a clear sky in a summer night ensures a heavy deposit of dew, and that the grass remains dry when the sky is overcast. These are related facts, but they are neither self-explanatory nor a law in themselves, as so many persons assume. The explanation, in accordance with simple physical laws, is due to Dr. Wells, a former physician of this hospital. Have any of you ever seen a large branch of a forest tree broken off on a clear summer night, when the air was perfectly motionless ? The destructive power of a hurricane is readily intelligible, but here absolute stillness of the air and clearness of sky are necessary conditions of the result. This looks like what I have termed an accidental or fallacious association ; but it becomes obvious and just when you remember that the dew, which is abundant on a clear night, is deposited on each leaf of the summer foliage, and that the slightest breeze

moving among the leaves would displace it. Imagine, nay calculate, the great weight of water a large branch would have to sustain at the extremity of the lever, with only two or three drops on each leaf, and then you have an obvious solution of this apparent anomaly. Snow is similarly destructive, especially to evergreens, when the air is still.

One further habit I would recommend you to cultivate, and that is the analysis of words, particularly those which are technically employed in our profession. Assuming a knowledge of Latin and Greek, I think you will find instruction as well as interest in decomposing compound words, and then in tracing the relation of their elements, and their association with the object or condition they are designed to express. But I will not pursue my subject further, for it is time that I finish.

I dare say many of you may think that I have ridden my hobby rather hard, and have occupied your time and engaged your attention with a good deal that is irrelevant to your professional studies. Well,—in order to disarm criticism, I am willing to plead guilty to this charge. But I did not undertake to read a formal medical paper, to deliver a clinical lecture, or even to confine myself within the limits of a strictly metaphysical discussion of my subject. My object, as I have already said, was rather to formulate what you already know, and to give you something to think over at your leisure, so that you may apply the suggestions I have offered, if they commend themselves to your judgment, in the daily routine of your work. I think you will find that this habit will make your studies more interesting as well as more profitable; for surely the ability to distinguish between true and false associations is worth cultivation. Moreover you will find this discipline very serviceable as an aid to accurate observation, which, in its turn, supplies the suggestive materials for reflection.

That many of our great discoveries have been due to the sagacious exercise of this faculty should act as an incentive to its careful education: for a ready perception of the relations of observed phenomena, combined with a healthy imagination, and controlled by reflection and an impartial judgment, are qualities more or less within the reach of all.

Genius is not a special attribute or abstract gift. It implies an alliance of many natural endowments, which find for themselves some special and appropriate channel. It is a mistake to suppose that genius can be fruitful without an effort on the part of the gifted possessor. Self-help and earnestness of purpose have characterised all whose record entitles them to be classed as men of genius. For the character and extent of our natural gifts we are not accountable ; but we are responsible for the training of those we possess, and for their cultivated exercise in our intercourse with our fellow men.

PARTIAL DISLOCATION OF THE HEAD OF THE HUMERUS BACKWARDS.

From 'St. Thomas's Hospital Reports,' 1889.

THIS case is placed on record on account of its peculiar, if not unique, character.

S. M—, a tall, spare, elderly gentleman, called on me on December 8th, 1874, about two hours after he met with an accident, which he thus described:—"I was mounting a three-barred hurdle, and while on the first bar the right foot slipped, and I fell with the fore-arm striking the top rail; for a second or two I thought the shoulder-socket was put out of joint, but finding I was capable of moving the arm to some extent I concluded it to be a severe strain only. The pain felt was chiefly at the top of the shoulder to the fingers' ends. It increased considerably during my hour's journey to London." This account was written, from the patient's dictation, immediately after he left me.

Before stripping the patient there was nothing apparently abnormal in the position or form of the arm. On exposure of the shoulder, and viewing it in front or behind, the existing deformity was very little perceptible, and the arm hung almost naturally by the side; the ability of the patient to move the humerus was very limited, and he could not raise it; there was neither flattening of the deltoid nor abnormal prominence of the acromion.

On careful examination the head of the humerus was found to occupy its natural position as regards height, but its projection in front of the acromion was absent, and there was an

abnormal prominence at the back of the joint behind and below the acromion. It was evident that the head of the bone had shifted its position directly backwards, so as to rest on the posterior edge of the glenoid cavity ; and this deformity was especially apparent on viewing the joint in profile, whilst standing on one side of the patient. On gently raising the elbow from the side and rotating the humerus, its head slipped into the glenoid cavity with an audible click, and the joint at once resumed its normal form and appearance ; the patient exclaiming that he lost his pain as soon as he felt and heard the bone go back.

In this case probably the subject of the injury fell against the bar of the hurdle, so that the force was conveyed upwards from the fore-arm, at the same time that the elbow was driven forwards whilst close to the side ; the head of the humerus would, in this way, be thrown upwards and backwards. The abnormal prominence was not behind the joint but on its posterior edge, so that the head of the humerus seemed, when facing the patient, to project even more than naturally.

I cannot doubt the exact nature of this singular injury, for the patient was very spare, and I saw him before any effusion had taken place around the joint.

A week's rest in great measure restored the use of the joint ; therefore I conclude there could have been no laceration of capsule or tendon.

I have not met with any recorded case of a similar nature to the above ; indeed, from the peculiarity in the abnormal position of the head of the humerus, it is an unlikely accident to occur. The amount and direction of the force exerted must have been exactly adapted to produce this particular result ; and no doubt the rotator muscles yielded sufficiently to permit the head of the bone to pass far enough behind the glenoid cavity to rest on its border : certainly a very trifling change of position enabled them to draw it back into proper relation with the scapula.

SOME REMARKS

ON THE

MECHANISM OF RESPIRATION.

(From the 'Proceedings of the Royal Society,' No. 131, 1872.)

1. In performing some experiments on recently slaughtered animals, for the elucidation of a subject which I was then engaged in investigating, I was struck with the remarkable, arched tension of the diaphragm, a condition which continued unabated until air was admitted into the pleural spaces, and then it became flaccid and descended. This altered condition was attended by collapse of the lungs, which receded from the thoracic walls, and occupied a much smaller space than previously.

2. In order to measure the quantity of air expelled from the lungs in the preceding experiment, and to ascertain how far the collapse of the lungs and the altered condition of the diaphragm were dependent on each other, the following experiment was performed. The trachea of a sheep, immediately after death, was exposed in the neck, divided, and tied over a glass tube, which was put in communication with a graduated receiver placed under water, and guarded by a stopcock. The pleuræ were then opened, and as air entered the diaphragm became flaccid; but the lungs remained unchanged in position and form. The stopcock was then opened, and a rush of air, displacing the water in the receiver, was accompanied by collapse of the lungs. The quantity of air thus forcibly expelled was from ten to twelve cubic inches.

3. The interpretation of this experiment is—

(a) That the passive tension of the diaphragm is due to the atmospheric pressure on its abdominal surface, which is not counterbalanced by a corresponding pressure on the opposite or thoracic surface, until air is admitted into the pleuræ.

(b) That the lungs retain their supplemental air by virtue of this tense condition of the diaphragm, the elasticity of the former being resisted by the tension of the latter.

(c) That the contractility of the lungs, tending to the expulsion of the supplemental air, removes the atmospheric pressure from the upper surface of the diaphragm, and thus produces and maintains its arched form and tense condition.

(d) That as soon as the pressure on the inner and outer surfaces of the lungs was equalised, by the admission of air into the pleuræ, their contractility forced out the supplemental air; and the quantity thus expelled may be accepted as an approximate measure of the elasticity of these organs.

(e) That the diaphragm was rendered flaccid by the admission of air into the pleuræ, independently of the collapse of the lungs.

4. Thus there exists a constant antagonism between the atmospheric pressure on the interior of the lungs and their elastic and contractile properties, tending to the expulsion of the air they contain; and this expulsive power is limited by the resisting tension of the diaphragm. These several conditions are in no degree influenced by the direct admission of air into the abdominal cavity; for the trachea being treated as in the former experiment before the abdomen was opened, and an aperture being then made into the peritoneum, the abdominal walls rose as air rushed in, but no air was expelled from the lungs. The expansion of the abdomen under these circumstances is especially remarkable in oxen when turned on their back, and is probably in great measure due to the position favouring the expansion of the lower costal region.

5. In the recognition of the above facts, I think that the extremely tense condition of the diaphragm has not received the notice which its practical importance deserves. Independently of being the agency by which the supplemental air is retained in the lungs, the resistance thus offered limits

the encroachment of the abdominal viscera on the thoracic cavity; and by this same property, combined with the broad and inseparable attachment of the central tendinous expansion to the fibrous pericardium, the heart is preserved from being impeded in its movements in the various stages of respiration.

That the tension in question fulfils these functions is exemplified pathologically as well as physiologically. It would indeed be impossible, without giving due weight to this property of the diaphragm, to account for the trifling interference, comparatively speaking, that pregnancy, or the presence of large ovarian tumours or ascitic accumulations, exercises over the mechanism of respiration; and it would appear still more surprising that the sudden removal of such distension, and with it the pressure on the diaphragm, is not attended by more serious consequences. Yet the respiratory mechanism is scarcely influenced appreciably even by the sudden collapse of an enormous ovarian cyst; and this is accounted for by the passive tension of the diaphragm, which alike resists encroachment from below and refuses the solicitation to descend which the removal of the pressure would seem to offer.

6. In the action of the diaphragm this tension is an essential condition, in order that there may be no waste of power, but that its earliest contraction may be accompanied, at once and simultaneously, by the entrance of the tidal air into the lungs; and it would seem probable that, for ordinary expiration, the suspension of its contraction and consequent return to its normal state of arched tension is alone sufficient.

7. But further considerations present themselves in reviewing this property, in association with the attachments of the diaphragm, and the relations of other muscles credited severally with functions in both inspiration and expiration.

8. The thoracic parietes, both osseous and cartilaginous, are movable, admitting of an increase or diminution in the circumference of the chest; and the diaphragm is attached, by its circumference, to the chest walls. As the force by which the tensely arched diaphragm is rendered plane is necessarily considerable, it may be asked, does the contraction of this muscle under any circumstances draw in the ribs?

and why does it not do so always? I believe the answer to the first inquiry to be, that it does under some circumstances, draw in the ribs; and the explanation of the second must be sought in a consideration of the agency of other muscles engaged in inspiration, to which attention will be presently directed.

9. The property of the diaphragm under consideration—its passive tension—is engaged in restoring the equilibrium of rest after a deep expiration. The supplemental air is expelled from the lungs chiefly by the action of the abdominal muscles, the circumference of the chest undergoing no appreciable change except at its lower part, where it is directly acted on by these muscles. When they are relaxed, and the lower costal region again expands, the diaphragm asserts its passive influence, by drawing in so much air as the counter-resistance of the contractility of the lung tissue will permit.

10. But this agency is somewhat more complex than would appear from the above statement. The passive tension of the diaphragm is such that it would probably be sufficient to resist the efforts of the abdominal muscles to force it upwards, without the co-operation of another cause, which is the altered condition of the chest walls. The lower ribs are perceptibly drawn inwards, as stated, when the supplemental air is expelled from the lungs; and, as a necessary consequence, the horizontal portion of the diaphragm is relaxed, and thus placed in a condition which permits of its being forced upwards, so as to compress the lungs.

11. But the deepest inspiration is also attended by hollowing or drawing in of the epigastrium; and the increasing circumference of the lowest costal region, which is limited as compared with the upper, is almost arrested before the act of forced inspiration has attained its maximum; and the rise in the abdomen is likewise suspended before this climax is reached. These conditions are due, I apprehend, to the combined effect of atmospheric pressure on the relaxed abdominal walls, concurrently with the extreme contraction of the diaphragm, overcoming the resistance of the intercostal muscles, and drawing in the lower ribs.

12. As exemplifying, in a remarkable and interesting

way, the foregoing observations, I may mention the case of a patient recently an inmate of St. Thomas's Hospital, in whom there was fracture, with displacement, of the sixth cervical vertebra, by which the cord was compressed. He survived the injury less than three days, and there was complete paralysis of motion and loss of sensation below a line level with the nipples; the movement of the arms was also impaired. "The walls of the chest across and below the nipples, were retracted at each inspiration." I quote the words of the Hospital Registrar; but I repeatedly proved this, and demonstrated the fact to others, by placing around the chest, just over the nipples, a tape, which became relaxed at each inspiration, to the extent of at least half an inch. The inspirations were short and sudden, the expirations prolonged, and latterly intermittent. This is not the only instance in which I have observed this phenomenon under similar conditions.

The following case has more recently come under my observation, and I give it according to the report of Mr. Anderson, the Surgical Registrar of the hospital:—"F. F—, æt. 58, a bricklayer, was admitted into St. Thomas's Hospital in February, 1871, having fallen from a considerable height and struck some projecting object in his descent; he remained incapable of movement, though perfectly sensible. The lower limbs were paralysed, and the movements of the upper extremities were impaired; and he complained of great pain shooting from the neck into the upper extremities. In breathing, the whole chest was very perceptibly drawn in during inspiration, and the abdomen became more prominent than is normal. The chest was slightly raised as a whole, and the sterno-mastoids were seen to act strongly. The lower ribs were not drawn downwards, but appeared to be pulled directly inwards, or inwards and slightly upwards. In expiration the chest walls appeared to relax, as if from the cessation of some contracting influence. The respiration, as a whole, was jerking, but not increased in frequency. Subsequently the chest appeared to act unilaterally, as if from unequal action of the two sides of the diaphragm, the ribs on the left side being drawn inwards during inspiration, whilst the right half of the thorax was thrust outwards passively. He survived the

accident about sixty hours ; and the cord was found crushed between the fifth and sixth cervical vertebræ, which were fractured."

This peculiarity in the diaphragmatic breathing must be due, in the main if not entirely, to the suspension of the intercostal action, whereby the ribs are left at liberty to be acted upon, and thus drawn in by the contraction of the diaphragm.

13. I would remark, as bearing upon the foregoing observations and those I am about to make, that in the unfettered adult body, in the erect or sitting posture, the sphere of respiratory movements, as seen and measured, is chiefly limited to the region which is bounded above by a horizontal line extending outwards from the lower extremity of the sternum, and below by a similar line extending from the umbilicus to the anterior spine of either ilium. In the recumbent posture, when the abdominal muscles are relaxed, the movement extends lower over the abdomen. Yet the measurements are by no means commensurate with the apparent movements. The deeply notched form of the chest below, with its movable elastic boundary of cartilage, is well adapted to admit of these necessary movements of alternate expansion and contraction.

14. A difference of opinion exists as to the action of the intercostal muscles, some physiologists assuming that the external and internal sets of muscles act independently of each other and as antagonists ; others supposing that different parts of the same muscle perform diverse functions. I am disposed to believe that both these conjectures are incorrect ; and that Haller is right in his opinion, that both sets of intercostals act as muscles of inspiration. They act, in concert with the scaleni, in drawing the ribs upwards ; they also approximate them, and rotate them on their axes,—a result which is facilitated by the increasing mobility of each pair of ribs as we descend from the first to the last. The effect of such action is to afford a fixed circumference from which the horizontal portion of the diaphragm can act without drawing the ribs inwards ; at the same time that the general capacity of the chest is augmented, though its vertical diameter, so far as the intercostal action is concerned, is short-

ened; and the crura of the diaphragm must also aid importantly in steadying and fixing the central tendon during inspiration, and in preserving the pericardium from that encroachment to which it would be liable if the central tendon were not thus fixed at its back part and drawn downwards from the chest.

15. But the action of the intercostal muscles, which has been a subject of so much dispute, will repay a more careful examination.

The posterior portion of the external intercostals, reaching from the angles to the tubercles of the ribs, unaccompanied by the internal intercostals, has an action similar to that of the levatores costarum, the upper of the two ribs to which each fibre is attached forming a fixed point from which the lower rib may be influenced in direction. The anterior part of the internal intercostals, passing between the costal cartilages unaccompanied by the external intercostals, must, from the direction of the fibres in relation to the direction of the portion of rib to which they are attached, act, like the posterior portion of the external intercostals, in elevating the ribs. (Here diagrams were employed to illustrate these points.)

It is hence obvious that the combined influence of these portions of the two muscles will be, where the fixed point is taken from the upper of the two ribs to which they are attached, to swing the rib in an opposite direction upon an imaginary axis drawn through the spinal and sternal attachments, taking a true rib as a type. The entire length of the external intercostals will also act with the levatores costarum, and produce the effect, in forced inspiration, of raising the anterior end of the rib, and thus thrust forward the sternum.

In the contraction of the decussating portions of each set of muscles simultaneously with the others, we get the diagonal of the action of both as the result of their joint contraction, the upper of the two ribs to which each pair of muscles is attached being relatively fixed.

16. The summary of the action of both sets of muscles may be thus stated:

(1) They increase the transverse diameter of the chest, by raising the curve of the ribs more nearly to a level with the

attachment of the ends. All the fibres must assist in this action, but especially the external intercostals and the anterior part of the internal intercostals.

(2) They increase the antero-posterior diameter of the chest by raising the anterior attachment of the ribs, and with them the sternum, more nearly to a level with the posterior attachment; thereby also separating the costal cartilages of the lower true and false ribs, and thus widening the interval which separates them on either side of the ensiform cartilage. The posterior fibres of the external intercostals will act with the levatores costarum and (in forced inspiration) with other indirect agents.

(3) They assist in rotating the ribs outwards when they elevate them.

(4) They fix the thoracic walls. This action is a most important one: (a) By giving, when needed, a fixed attachment for the various muscles which are connected to the chest, and which have a double action, according to the relative mobility of their origin and insertion. (b) By preventing the diaphragm from drawing in the walls of the chest during ordinary inspiration. (c) By resisting the atmospheric pressure during inspiration, by virtue of the tension of the intercostal spaces.

17. The serratus magnus is usually described as a powerful muscle in forced inspiration when the scapula is fixed; but from a careful study of the direction of its fibres, from observation of its action in deep breathing, and (so far as the experiment may be depended on) under the influence of electro-galvanism, I venture to question the correctness of this generally accepted description. The direction of the component parts of this broad muscle would seem to indicate that none but the lowest digitations can assist in elevating the ribs or increasing the capacity of the chest; on the contrary, the contraction of the upper digitations must rather tend to draw the ribs downwards and to aid in expiration. It is true that extreme elevation of the scapula somewhat alters the relations of the origin and insertion of this muscle, but not to such a degree as to impart to it its assumed power, even if such elevation were, as it is not, a necessary condition in forced inspiration. Further, a careful observation of the

well-marked digitations of this muscle in a well-developed and thin person, during the act of forced inspiration failed to discover, either tangibly or visibly, any contraction of their fibres, which was very distinctly marked when the scapula was moved. In stimulation of the muscle by electro-galvanism, though the scapula was freely jerked and moved about, no movement whatever of the ribs or interference with respiration resulted. But it must be admitted that not much importance can be attached to this experiment, as the more movable attachment of the muscle would necessarily yield most readily during its contraction. Indeed this remark applies to all experiments of this nature, in which a single muscle is stimulated to contract, without reference to the co-operating or antagonistic action of other muscles. Such isolated experiments are therefore not only unsatisfactory but often delusive.¹

But the question which I have raised may be discussed a little more in detail. The inferior angle of the scapula reaches as low as the eighth rib, while the thorax is in a state of repose after an ordinary inspiration. The lowest digitation of the serratus magnus, arising from the extreme end of the angle, follows the course of the eighth rib, and is attached to it. Assuming for a moment the capability of the serratus magnus to act in inspiration, it would be necessary for this result that the vertebral costa of the scapula be drawn back and rigidly fixed by the rhomboids, &c.; the consequent extension of the fibres of the serratus is further enhanced by the expansion of the chest during forced inspiration—a condition which is not consistent with what is observed in other muscles during a passive imitation of their action. In other words, the relation of the fibres of this muscle to the ribs is such, that a passive imitation of the action ascribed to them is to make tense and not to relax them; they have to run over a longer surface—a wider barrel. But the fact is, that the lower angle of the scapula is neither fixed nor in any marked degree drawn up in deep inspiration; but the angle and vertebral costa are carried further away from the spine; and as the serratus is, as already remarked, not visibly or tangibly in action, this result can be accomplished only

¹ The original paper is illustrated by diagrams, which are here omitted.

by the costal attachments of the muscle being removed to a greater distance from the spine, by the expansion of the chest. Each digitation of the muscle acts at an increasing disadvantage as we ascend from the last to the first; therefore, if the lowest digitation is incapable of acting as an elevator of the ribs, the same negative conclusion must, *à fortiori*, be arrived at as regards the rest of the muscle.

It is no doubt true that the serratus is in action during deep inspiration when the arm is raised. But this contraction is persistent during expiration also; and the action in each instance is explained by the fact that this muscle is required to assist the trapezius in rotating outward the lower angle of the scapula, and maintaining it in that position, in order to accommodate the relation of the glenoid cavity to the head of the humerus, and to afford a fixed attachment for the action of the deltoid. The chest is, under these circumstances, the relatively fixed origin of the serratus, and the scapula its movable insertion on which it acts.

18. A parity of reasoning applies to the pectoralis major muscle. This muscle is described as assisting in forced inspiration, by raising the ribs and dilating the chest. I think this assumption incorrect for the following reasons:—

(1) A necessary condition to the action of this muscle on the thorax is the relative immobility of the scapula and humerus; but in a healthy chest the most powerful inspiratory effort may be made without any such assistance; and the pectoral fibres may be felt and seen to remain during this effort in a state of complete inaction. When the humerus is fixed the fibres are in action; but this condition is due to their agency in fixing the bone.

(2) The clavicular and upper portion of the sternal fibres may be considered as incapable of raising the ribs, whilst the arm is not elevated; the lower fibres alone can be supposed to possess this property or power. Now the lowest fasciculus is not attached to the ribs, but terminates in the aponeurosis of the abdomen by a broad fibrous expansion; this portion of the muscle can take no part in raising the ribs. The set of fibres above these arises from the sixth rib and its cartilage, and from the adjacent portion of the sternum; they are inserted into the upper part of the outer

margin of the bicipital groove, on a horizontal plane with the sternal attachment of the third rib and the spinal attachment of the sixth rib. In deep inspiration the effect of forward movement of the sternum will nearly, if not entirely, correspond with that of the elevation of the anterior attachment of the rib; so that the pectoral fibres will not be appreciably shortened, and consequently cannot materially assist in the inspiratory effort. If we ascend a step higher, to the fifth rib, it would appear that the pectoral fibres will rather resist than assist in the act of inspiration; still more is this the case nearer to the clavicle.

When the arms are raised above the head the great pectoral muscles would have an undoubted action in elevating the ribs; but such a position is never assumed, even in disease, for the purpose of assisting inspiration.

19. Indeed the same may be said of the serratus magnus and pectorales as of the intercostals and other muscles credited with agency in respiration,—that their action must be studied in relation to that of other muscles which have an important influence in modifying or even in determining their action; and bearing this in mind, and for the reasons adduced, I think it very questionable whether any of these muscles can exercise an influence, except under special conditions and to a very limited extent, in the act of inspiration.

20. The conclusion to which the foregoing observations point is, that the act of inspiration is, under all circumstances, essentially, perhaps exclusively, dependent on the special muscles appropriated to this function—muscles which are competent, without extraneous aid, to answer the appeal made to them in emergencies as well as under ordinary circumstances.

21. The action of the scalenus anticus, a powerful muscle, is essential for fixing the first rib in inspiration; and it may be distinctly felt so acting in a thin neck during forced inspiration, when the rib into which it is inserted is raised with the sternum. The scalenus posticus has a similar action on the second rib. The pectoralis minor, when the coracoid process is fixed, and some few other unimportant muscles, may assist in the elevation of the ribs. In the absence of fixation of the upper or lower ribs, if such condition ever

exists, it is difficult to resist the conclusion that the action of the intercostals must necessarily limit the capacity of the chest, by drawing the ribs towards each other and rendering the intercostal spaces rigid.

Of the lower ribs, experiment has satisfied me that both the tenth and eleventh are raised during deep inspiration—the latter in a less degree than the former. The intercostal spaces between the tenth and eleventh, and between the eleventh and twelfth ribs, are consequently widened considerably. The last rib is probably fixed by the attachment of the quadratus lumborum: this rib feels prominent and fixed during inspiration; whereas, under ordinary circumstances, it is loose and not easily felt.

With the view of ascertaining the mobility of the sternum, and of comparing the antero-posterior and lateral movements of the chest, I procured a large pair of callipers, with a fixing screw attached. I may thus state briefly the result of my observations on healthy individuals.

22. There is no perceptible increase in the antero-posterior diameter of the chest in ordinary inspiration. The antero-posterior diameter of the chest is augmented perceptibly in forced inspiration at the junction of the second rib with the sternum, and but slightly more so at the junction of the sixth rib with the sternum. The mean of the experiments gives about $\frac{5}{8}$ of an inch, the variation being from $\frac{3}{8}$ to $\frac{7}{8}$ between a state of rest and that of deep inspiration. (An explanatory diagram was here shown.)

The difference between expiration and a state of rest, in either of the above measurements, is about the same as between rest and inspiration, the latter being somewhat in excess, especially at the lower true ribs.

The lateral diameter of the chest, in deep inspiration, is augmented, absolutely as well as relatively, to a greater degree than the antero-posterior, in the proportion of 6 or 7 to 5, opposite the fifth or sixth rib; but the maximum increase appears to be attained at about the eighth rib, where the mean is as 10 to 5.

The movements of the sternum follow those of the costal cartilages, and are dependent on them. These movements, which occur in forced inspiration only, consist in an alternate

advance and sinking of the bone, which is most marked at its lower extremity.

23. The first rib is certainly capable of elevation during inspiration, and the anterior and middle scalenus muscles perform this office : probably their agency is limited, in ordinary inspiration, to fixing the rib. In forced inspiration, the action of the clavicular portion of the sterno-mastoid is first apparent, and subsequently that of its sternal portion.

24. In ordinary expiration no muscular action is exerted ; but in extraordinary expiration the ribs are drawn down by the abdominal muscles, at the same time that the abdominal viscera are pressed upwards. The intercostals assist in this act when the lower ribs are thus fixed. The levator ani is an essential auxiliary in forced expiration. I do not attach much value to the agency of the triangularis sterni and serratus posticus inferior as muscles of expiration. I am disposed rather to regard them as agents in steadying the ribs for the diaphragm, and as antagonists, severally, to the pectoral and latissimus dorsi muscles, thereby affording them a more fixed attachment at their origin.

25. The generally received assertion that there is a marked difference in the respiration of the two sexes, *i. e.* man and woman, confirmed, apparently by the observations of Hutchinson on young girls, has always struck me as very remarkable ; for, whatever hypothesis may be adduced to favour the relative advantage of such peculiarity, as regards woman, there certainly is no anatomical difference, either in the *natural* osseous conformation of the chest or in the muscular apparatus of respiration, to account for the predominance of the abdominal type of breathing in the male, and of the thoracic type in the female.

It naturally occurs to anyone, in contemplating this circumstance, to attribute something to the peculiar dress of civilized women—the fashion of compressing the lower part of the chest, which is universal. There can be no doubt that this compression, commenced as it is at a very early period amongst *all* classes, long before the development of the skeleton is completed, must exercise a permanent influence in altering the form of the chest, and must thus impart a factitious reality to that which is not natural. I believe that

the early age at which this compression is begun, even amongst the lower orders, as I have ascertained by inquiry, has possibly misled so careful an observer as Hutchinson. I have repeated his experiments on young boys and girls, but with results at variance with those which he obtained. These results may be thus stated.

26. In *ordinary respiration* the upper costal respiratory movements are equal in male and female ; they are increased in both by girding the abdomen and lower ribs with a roller. The lower costal movements are also equal in the two sexes, and not perceptibly affected by the action of the roller.

The difference in the thoracic girth in either sex between ordinary expiration and inspiration is very slight, indeed scarcely perceptible.

27. In *extraordinary respiration* the costal movements, both upper and lower, are much greater in forced inspiration in the male than in the female. The lower costal movements are much interfered with, in both, by the compression of the abdomen and lower part of the chest, while the upper costal movements are exaggerated.

I may add that, in the adult female, there is, as might be expected, a striking difference in the relative mobility of the chest and abdomen, when the respiratory movements are observed whilst the usual tight dress is worn, and when the figure is at liberty to expand more naturally on removal of the dress.

28. Moreover, the form of the bust in the female lends a further aid to the influence of dress, by exaggerating the thoracic movements. Thus in stout women with full bosom, the rise and fall of the chest is much more apparent than in those in whom the bosom is spare and ill-developed. This may be partly accounted for by the greater interference which is due to the increased compression exerted to reduce the size of the waist by stout women, but not wholly so. An artificial arrangement on the upper part of the chest of the male, by which prominence is given to this region, when the waist is compressed, at once exhibits distinct thoracic movements which were not otherwise perceptible. I am disposed, therefore, to believe that the asserted natural difference in the respiration of the two sexes is due to the altered

form of the chest, consequent on compression, and to the habitual confinement of the lower costal region, which necessitates the habit of thoracic breathing. It is to be regretted that experiments to determine this question have not been conducted in some uncivilised community, which has not attained to the cultivated refinement of endeavouring to improve the natural symmetry of form at the expense of health and comfort. I am not aware that any such attempt has yet been made.

P.S.—Since writing the above, I have had the opportunity of conversing with M. Duchenne, who performed some experiments with electro-magnetism at St. Thomas's Hospital, to demonstrate the action of various muscles.

He expressed himself strongly respecting the action of the intercostals as exclusively muscles of inspiration. This opinion is based partly on experiments performed upon decapitated criminals, and partly on clinical observations in cases of muscular atrophy. Immediately after death M. Duchenne applied the stimulus of an interrupted current to the intercostal muscles, with the result of raising the ribs. He stated that he isolated as far as possible the external from the internal set of muscles, and found stimulation of either set produced the same result. I give these statements as I received them, but I did not witness the experiments referred to.

The following are the chief points, either disputed or not previously recognised, which it is the object of the preceding observations and experiments to establish :

1. The normal state of the diaphragm, when at rest, is that of arched tension ; and this condition is due to the elasticity of the lungs resisting the atmospheric pressure on its thoracic surface.

2. This tension is such that the diaphragm cannot be forced upward whilst the ribs are fixed ; and is exerted in drawing the ribs inwards when the intercostal muscles are relaxed.

3. The results due to this passive tension are that (a) it retains the supplemental air in the lungs ; (b) it limits the encroachment of the abdominal viscera on the thoracic cavity ; (c) by virtue of the attachment of the pericardium to the

cordiform tendon, the uniform calibre of this bag is secured, and the heart is thus protected from being impeded in its movements during respiration, the crura taking part in maintaining this condition when the muscle contracts ; (d) it economises active power in inspiration.

4. *Inspiration.*—When the upper ribs are fixed by the scaleni, both sets of intercostal muscles act in increasing the transverse diameter of the chest, by raising the curves of the ribs and the sternum.

They rotate the ribs outwards.

They fix the thoracic walls, and thus antagonise the tendency of the diaphragm to draw inwards the ribs to which it is attached. A fixed circumference is thereby secured, from which the diaphragm acts in altering its own form ; and this is one of the most important functions of the intercostal muscles.

They assist in expiration when the lowest ribs are fixed by the abdominal muscles.

5. The scalenus anticus and posticus (especially the former) are auxiliaries in inspiration by raising and fixing the first and second ribs, and thus rendering them relatively immovable.

Thus, when the scaleni act, the intercostal muscles raise the ribs ; when the scaleni are at rest, and the abdominal muscles act, the intercostals depress the ribs ; if neither the scaleni nor abdominal muscles were to act, the ribs would be approximated at their centre by the action of the intercostal muscles.

6. The pectoralis minor (when the coracoid process is fixed), the lower costal portion of the pectoralis major, and some other muscles of minor importance might assist in elevating the ribs ; but it is questionable whether they ever do so in such way as to assist in inspiration.

7. The serratus magnus has no action in inspiration ; all but its lowest digitation must draw the ribs downwards, if they act on them at all.

8. The action which the sterno-mastoid is capable of exerting in inspiration is by fixing the first rib through the medium of the clavicle, and by raising the sternum. This is not required in health, but may be witnessed occasionally in disease.

9. *Expiration.*—Ordinary expiration is accomplished by

the elastic resiliency of the lungs, the tense diaphragm resuming its arched form when the muscle ceases to contract : the elasticity of the ribs and abdominal parietes may assist to a limited extent ; after a deep inspiration this elasticity has a more important share in expiration. The abdominal muscles, which, conjointly with the levator ani, are the agents of forced expiration, do not act by urging the abdominal viscera against the *tense* diaphragm, which would resist the pressure, to the injury of these viscera, but against the *relaxed* diaphragm—relaxed, that is, by the abdominal muscles drawing down the lower ribs, and thus contracting the circumference of the lower part of the chest.

The intercostal muscles also contribute importantly to this result, as the effect of their contraction is reversed, by the lower ribs being relatively fixed during the action of the abdominal muscles. In this way both the long diameter and circumference of the chest are abridged.

10. The upper and lower costal movements in both sexes, when entirely unfettered, are equal, in ordinary inspiration and in the uncontracted chest.

The costal movements, both upper and lower, are much greater in forced inspiration in the male than in the female.

In both, the lower costal movements are much abridged by compression of the abdomen and lower part of the chest, while the upper costal movements are exaggerated.

The observed fact that women breathe more by the chest than by the abdomen is due to artificial compression, and to the altered form of the chest consequent on its early adoption.

SOME REMARKS

ON THE

ANATOMY AND PHYSIOLOGY OF THE URINARY BLADDER,

AND OF THE SPHINCTERS OF THE RECTUM.

(From the 'Journal of Anatomy and Physiology,' vol. xvii, 1883.)

THE usually accepted views on the physiology of micturition have always seemed to me unsatisfactory. The subject is a perplexing one, much more so than is apparent until it is carefully investigated; and it is only after much consideration that I venture to express dissent from the opinions generally received, and my reasons for adopting others in their stead. The value of a correct view is, in this instance, enhanced by the light thereby thrown upon many obscure pathological conditions, which, in their turn, serve to illustrate the physiology allied with them. The chief points I propose to discuss are:

1. How the urine is expelled from the bladder.
2. Under the influence of which of the nerve-centres the expelling force acts.
3. How the urine is retained in the bladder under different circumstances.
4. The relation of various pathological conditions to the physiological explanation offered.

I may remark that I once wrote a paper on this subject, which was published in the 'London Medical Gazette' for

June 18, 1836. It attracted little attention, because it contained doctrines which were regarded as crude and erroneous ; for such was the view then taken by most physiologists of Marshall Hall's great discovery. Reflex physiology was just struggling into life, amid all the detraction and opposition which so commonly herald and accompany the announcement of new views which revolutionise previously established opinions. I have only recently disinterred this forgotten production of my youth ; and this is the explanation of my renewing the inquiry after so long an interval.

Anatomy.—The arrangement of the fibres which constitute the *muscular coat* of the bladder is such as to enable it to contract uniformly on its contents. When the organ is elongated by distension, the longitudinal fibres shorten this diameter ; and when partially emptied, the circular and obliques fibres are probably more actively engaged. The circular bands increase in number as they approach the neck of the bladder, where they form a more compact layer, especially when the bladder is contracted.

The position and relations of the *prostate gland* are such that it probably exercises but little if any influence on the passage of the urine. Circular muscular fibres constitute a considerable element in the vesical half of its structure, and therefore behind the opening of the ejaculatory duct. My friend and former pupil, Mr. Anderson, conjectures that these fibres have for their function the occlusion of the urethra at this part during emission of the semen ; and no doubt they express the secretion of the gland at the same time and in the same required direction, so as to bring both secretions within the grasp of the ejaculator muscles. These prostatic fibres can scarcely be credited with any agency associated with micturition, as they have no homologue in the female. The relation of the levator ani to the prostate might suggest that this muscle is capable of compressing it, and of thus aiding in closing the urethra. But it is more than doubtful whether these fibres in any degree envelop the gland, as usually described by anatomists, after Santorini ; they really pass from its sides on to the rectum.

The *membranous urethra* is composed of elastic and erectile tissues, with circular muscular fibres. The female urethra

corresponds, in position and structure, with this portion in the male ; but its elastic fibres, as well as its erectile tissue and the muscular fibres which encircle it, are more developed in the former than in the latter. There is one muscle common to both sexes, viz. the *compressor urethræ*, which surrounds the urethra whilst beneath the arch of the pubes and between the layers of the triangular ligament. It is needless to say that, although the accelerator urinæ and erector penis have their homologues in the female, their function in this sex has no relation to the act of micturition.

The *vesical nerves*, derived from the lower part of the hypogastric plexus, consist of spinal nerves, intermingled with others derived from the lumbar and sacral ganglia of the sympathetic.

Impressed as I was with the prevailing belief that the emptying of the bladder is a purely reflex act, I proceeded to examine the correctness of this view in the following way. Given, a bladder containing a small quantity, say three or four ounces, of water, and no desire to expel it, how is micturition accomplished ? The ability cannot be doubted ; and the act is clearly voluntary. The exercise of the will must be either in active expulsion, or in suspension of obstructive control. But this difficulty has been met by the assertion that contraction of the abdominal muscles is the initiation of the act. I therefore tested this statement by a careful examination of the condition of these muscles during micturition, in various states of the bladder as regards the quantity of urine it contained, with the result of satisfying myself that there is no evidence to support this supposition. Moreover, no voluntary effort of the abdominal muscles suffices, by itself, to stimulate the bladder to respond, when its action is suspended emotionally, as by nervous apprehension or shame, —a condition to which this organ seems peculiarly susceptible, though not singularly so ; for strong emotion will paralyse other muscles which are more directly subject to the will ; or, more properly speaking, which are less generally influenced by the excito-motor centre. No doubt the abdominal muscles may be employed voluntarily, and usually are so when a desire exists to accelerate the passage of the urine ; and also immediately preceding the final ejaculatory act by

the perineal muscles : but my contention is that, unless thus called into action, these muscles are perfectly passive. Any contraction of the abdominal wall, which would suffice to initiate the act of micturition when the bladder contains only a small quantity of the water, must, in a thin person, be obvious to the touch. But experiment may satisfy anyone that voluntary contraction of the abdominal wall, so far from facilitating the commencement of the act, really obstructs and delays it ; the effort is sensibly of a different nature. In defæcation, likewise, though the abdominal muscles very generally take an active part, their intervention is not essential ; the peristaltic movement of the intestine can by itself suffice, as proved in diarrhœa, or, still more manifestly so, where voluntary power is suspended by disease or injury.

If, however, under the conditions mentioned and excluding the abdominal muscles from any necessary participation, it be still maintained that the muscular coat of the bladder is not under the direct government of the will, the only alternative is to assume that the bladder needs and possesses a strong sphincter, which is in constant reflex action, controlling the outlet ; that the will is capable of inhibiting this reflex action ; and that such control, when exercised, simultaneously excites the reflex contraction of the bladder. But can such a complicated assumption be regarded as consistent with accepted physiological doctrine and observation ? I believe not ; even if the assumed need for the presence of such a sphincter were admissible, which I shall endeavour to show is not the case. In thus expressing myself I do not intend to deny that the bladder may and does act under reflex influence. All muscles are subject, more or less, to this agency, and probably the bladder is peculiarly so. What I contend for is that the will has direct power in determining its contraction. But I hope to illustrate this branch of the subject further on.

I now proceed to inquire how the bladder retains its contents under different circumstances. In considering this question in relation to both sexes, it is necessary to exclude the prostate gland and the urethra in front of its membranous division, which is, in the male, the homologue of the female urethra.

Assuming, for the sake of argument, that the bladder requires a restraining sphincter, what muscular arrangement exists by which the expulsion of the urine may be controlled? If the annular fibres around the neck of the bladder be credited with this function, then the inhibition of their action must be voluntary and synchronous with the reflex contraction of the muscular coat of the bladder generally, with which they are continuous and intermingled, as well as identical in structure. I have already stated my reasons for rejecting this supposition. Moreover, these circular fibres are not aggregated in the form in which we should expect a sphincter muscle to present itself when the bladder is distended; but they are so arranged as to constitute a detrusor muscle when and where it is most required, viz. when the bladder is nearly emptied and the urine gravitates towards its neck; just, in fact, as the mixed annular fibres at the lower part of the rectum act in expelling its contents, after being expanded by the pressure from behind.

I formerly thought (as expressed in the paper to which I have alluded) that the accelerator urinæ might act as a sphincter; but, except under special circumstances, I do not now think this is the case, for the retaining power of the bladder seems to be very little interfered with when the urethra is laid open behind the bulb: moreover, its homologue in the female can have no such action. The position of the compressor urethræ is such as to qualify it to close the opening from the bladder into the urethra; but would the inhibition of its action suffice to liberate that opening and to stimulate the muscular coat to reflex action when the bladder contains only a small quantity of water? I apprehend that such an explanation could scarcely be entertained seriously.

In considering the retaining capability of the bladder we have to take into account the hydrostatic condition of the organ, the elasticity of its outlet and excretory duct, and the muscular apparatus in connection therewith. Of these I consider the first or passive resistance to evacuation as by far the most potential. For all practical purposes we may regard the bladder as a spherical reservoir with but one outlet, as the ureters are really closed against any retro-

gression of the urine. If the ratios of the pressure between this large reservoir and the small cylindrical tube with which it is connected are as the respective areas of the tube and cistern, the collapse of the urethral wall could easily counter-balance a very considerable hydrostatic pressure, together with that which is exerted by the elastic resiliency of the distended bladder. My friend, Dr. Stone, whom I have consulted on this point, informs me that he estimates the tension on the internal area of the bladder to be about 560 times that on the vesical outlet. A certain allowance must also be made for the friction consequent on the passage of the fluid through a long and tortuous channel. The absence of this obstructive agency in the female ought to be, and I presume is, attended with increased force in the current of the fluid when it leaves the canal. Experimentally we know that this passive retaining attribute of the bladder exists. After death we often find a considerable quantity of urine in the human bladder, and also in the bladders of slaughtered animals; in neither case is it expelled, as it would be if the retention were dependent on muscular action. I have often seen the fluid contents of the stomach discharged by the mouth, immediately the diaphragm has relaxed its hold on the cardia in death, and the elastic pressure of a distended abdomen has been therefore unopposed. If we superadd to this passive resistance in the bladder that offered by the elastic and muscular texture of the urethra, which is more developed in the female than in the membranous division of the male canal, we have in my opinion, a satisfactory explanation of the normal retention of the urine.

But, as we are conscious of the desire to micturate, so are we sensible of being able to exercise an effort to restrain the action of the bladder. What is this? In the first place, I believe it to be a voluntary inhibition of the contraction of the bladder when stimulated by a centripetal exciting cause, whether that be an appeal to the sensorium or to the spinal centre. Sometimes in the contest, resulting from over-distension or morbid irritability of bladder, volition is compelled to yield. But beyond this passive restraint there is the compressor urethræ muscle, which, though feeble in itself, acquires considerable importance from its position at the

outlet and its relation to the urethra. If the hydrostatic pressure on the vesical outlet is relatively so inconsiderable, it is not unreasonable to believe that the action of this small muscle sensibly augments the retaining power of the bladder. Probably this function is exercised only when the bladder is distended, and as a reflex consequence of such distension; but it may, like that of the cutaneous sphincter and in similar circumstances, be exerted under the direction of the will. Thus, I infer that the effort by which we control the desire to micturate is due to the restraint exercised by the will, and to the action of the compressor urethræ muscle, which may be regarded as analogous in its relations and functions to its more powerful neighbour, the cutaneous sphincter of the rectum. Both are called into action in the erect posture, and during any exertion in which the abdominal muscles are usually engaged, as in coughing. And I may here remark that, if my data and argument be not impugned, it is impossible to suggest any sufficient check to the evacuation of the bladder, when sensibly stimulated by distension, unless it be, at any rate chiefly, that of direct voluntary control over the expulsive force; and if such exercise of volition be admitted, it seems to me that the direct predominant agency of the will in determining the expulsive action cannot be denied, *i. e.* so long as sensibility is unimpaired.

I will now say a few words respecting other parts of the male urethra. As regards the prostate I do not think, as I have already remarked, that the healthy gland exercises any influence on the passage of the urine through it, but in front of the membranous urethra the presence of a powerful muscle, the *accelerator urinæ*, commanding the passage, requires notice. Its special function in micturition is to clear the passage in front of it of the water that would otherwise dribble away. This is accomplished not only by compression of the bulb, but also by producing, in concert with the muscles of the crura, a momentary distension of the erectile tissue, which passes forwards as a wave towards the extremity of the canal. But the accelerator muscle has another function which must be necessarily absent in the female, *viz.* that of suddenly arresting the flow of water during micturition. I believe, from observation of such cases, that spasm of this muscle is

the usual obstruction in what is termed spasmodic stricture ; and that otherwise this form of obstruction (except it be also in the membranous urethra and due to the compressor muscle) is very much of a myth, which has often served the purpose of an excuse for clumsy catheterism. Further, I do not doubt that, in some instances, the accelerator muscle, when acting under reflex influence, is capable of resisting considerable pressure from behind. To compensate for this, and for the resistance from friction in the male canal, both the elastic and muscular elements of the female urethra are more developed than in the membranous urethra of the other sex. Even the erectile tissue, especially in the female urethra, may aid, when the compressor is in action, in closing the canal. In the erect posture and during active exertion there is a general tonic contraction, not only of the sphincters, but also of the levator ani and other muscles commanding the pelvic outlet. A similar arrangement may be observed even in ordinary inspiration when the body is erect : the abdominal muscles are no longer the passive wall that they are in the recumbent posture, for the abdominal breathing is not then so pure and simple ; but it is limited, for an obvious reason, by the tonic action of the surrounding muscles.

I may here notice an objection which will naturally be raised to my argument, and that is the anatomical distinction between the voluntary and involuntary muscles. But are we to reject the proposition that the muscular coat of the bladder is under the direct influence of the will because it is composed of unstriped fibres ? If so, why not deny involuntary activity to the striped fibres of the heart, pharynx, and œsophagus, or voluntary action to the ciliary muscle ? This physiological distinction on anatomical grounds is only arbitrary, and is unsupported by any physiological necessity of alliance between structure and function. Why some muscles are striped and others unstriped is an unsolved problem, which may hereafter be shown to characterise differentially their functional activity, or to have more relation to the distribution of the cyclo-ganglionic nerves than to any special function associated with the cerebro-spinal system ; or to be totally unconnected with either. I may further observe that

most spinal-reflex acts are more or less subject to the control of the will. Such is the case with the action of the sphincters, the larynx, the diaphragm. The contraction of the pharynx and œsophagus seems to be purely reflex, though the initiation of swallowing is voluntary ; and these specially reflex and involuntary muscles belong to the striped class.

In studying the reflex phenomena one cannot fail to be struck with the remarkable development of this function in early life. Reflex movements, under appropriate stimulants, are most manifest where voluntary influence is most deficient ; and the converse is also true. The will has to be educated and habit must be acquired before volition supercedes reflex action. These remarks apply to the act of micturition as well as to the action of muscles generally. Indeed, until education and habit have asserted their sway, it would seem that the evacuation of the bladder is a purely reflex act. This is remarkably exemplified in the case of anencephalous infants, in which not only are respiration and deglutition performed naturally, and the limbs moved when excited, but the sphincters are active, and the urine and fæces are voided. A case of this kind is narrated by Sir William Lawrence in the fifth volume of the '*Medico-Chirurgical Transactions* ;' and this account preceded the discoveries of Dr. Marshall Hall, who quotes similar instances given by Lallemand and Ollivier. The fact is, that all the actions essential to the maintenance of earliest life, including suction, are reflex ; and is it not the fact that in old age, as the energy of the will (in a physiological sense) abates, reflex influence again becomes relatively more active, as manifested especially in morbid conditions of the frame ? The controlling power of the will is evoked by education and confirmed by habit ; the primitive condition offering an interesting subject of study in contrast with that which is presented in after-life, when volition is suspended by cerebral or spinal injury. The influence of habit is exemplified by control of the bladder during sleep, by the phenomena of somnambulism, and in various other ways known to physiologists. In like manner, numberless voluntary acts become purely automatic by habit ; they are performed unconsciously, and even when they would be checked if the will were not slumbering.

Still more striking instances are on record of such habitual movements occurring when the brain is incapable of taking cognisance of external objects. The power of association also is manifested in the desire to urinate which is excited by washing the hands, retiring to bed, &c. Similar instances illustrate the influence of habit and education in domestic animals. The puppy will pass water whenever his bladder is distended, and wherever he may be; but the adult and trained dog will remain for hours indoors without urinating, although he will do so repeatedly and at short intervals when running free. The horse, again, will delay to stale on a long journey until he reaches his own stable. But it is unnecessary to pursue this subject further.

In studying the Pathology of micturition we have to consider those conditions in which the bladder either expels or retains abnormally its contents; in other words, incontinence and retention: and each of these states may be the result of disease or injury.

Incontinence may occur at any age, and is due to various causes. In children it is not uncommon during sleep, after education has been confirmed by the habit of retention at other times. Various remote causes may operate in exciting the act under these circumstances; but the explanation is that the centripetal stimulus is abnormally strong, or the habit of control is too feeble to resist it. At any period of life an irritable or inflamed state of the vesical mucous membrane, the presence of an irritating body in the bladder, or an unhealthy condition of the urine, or even strong emotion, will produce the same result. Incontinence in hysteria is infrequent, but may be referred to a capricious or enfeebled exercise of the will. In old age I believe the explanation of incontinence to be, in most cases, the simple overflow of a distended bladder. The supposition that the urine passes directly from the ureters through a collapsed and atonic bladder is forbidden by the operation of the hydrostatic law already referred to, even assuming that all active obstruction is removed. In such cases the urine may be retained whilst the patient is in the recumbent posture or at rest; but exercise in the erect posture is accompanied by its discharge.

This is attributable, in great measure, to the pressure of the abdominal muscles on the bladder, together with the stimulus to urinate consequent thereon. Females, in like manner, are occasionally subject to incontinence during pregnancy, when coughing or exerting themselves; the same explanation applies in this instance, as also in some convulsive affections besides hysteria, such as epilepsy and chorea, in which the urine is occasionally expelled during the attack. In the aged, however, there is sometimes, indeed not infrequently, a morbid sensibility of the mucous membrane of the bladder, which, in concert with enfeebled power of control and relatively augmented reflex activity, produces incontinence.

The causes of *retention* of urine may be mechanical or physiological. The former class of cases present themselves in the form of an enlarged prostate, diseased growth in the bladder, the presence of a stone or clot of blood, stricture, &c. But these may be dismissed with the remark that hypertrophy of the vesical muscular fibres, so frequent in some of these cases, is a condition which is common to both voluntary and involuntary muscles when stimulated to increased action; and therefore this muscular growth does not affect the physiological question under discussion. Retention in old age is usually the consequence of defective voluntary control over an enfeebled bladder. But this condition, as already remarked, may be associated with morbid irritability of the mucous membrane, exciting occasional reflex contraction, and incontinence as a consequence. Simple dribbling of the water in retention, which is much more frequent, is the result of pressure from distension gradually overcoming the resistance of impaired textures in front. In such cases the habit of retention is progressive without the knowledge of the patient, until at length incontinence reveals the truth. Hysterical retention, or what is so called, is more often met with than incontinence. It is a singular affection, for the bladder sometimes becomes enormously distended before relief is sought, or even complaint made. Some such cases are referable to a morbid mental or moral condition, which, if yielded to by the medical attendant, entails his constant interference. When genuine, the only explanation I can offer is that the exercise of the will is perverted or in abeyance, and

that the mucous membrane is in a state of morbid insensibility, as manifested by the indifference to the distension; the consequence being that the peripheral extremities of the afferent nerves fail to convey an impression sufficiently lively to induce contraction of the bladder. A temporary incapacity to pass water sometimes occurs in nervous persons, when in the presence of strangers. This is evidently a suspension of the power of exercising the will under mental emotion, and appears to confirm the view that the beginning of the act is under direct voluntary control. Certainly in this condition no contraction, however active, of the abdominal muscles avails to stimulate into action the muscular coat of the bladder. I cannot believe that any reflex obstruction at the neck of the bladder or in its vicinity can account for this peculiar condition; for the victim of it is incapable of even making an effort to relieve himself.

Incontinence or retention may result from injury. Where the former is the case (except in excessive distension) the lesion must involve the restraining neck of the bladder, as, for example, in dilatation or section of the female urethra for extraction of a stone. The urethra in front of the neck may be largely dilated without necessarily entailing incontinence. The same is the case, apparently, in the male urethra; for Mr. Cock informs me that he has had at least two cases in which, after his operation of puncturing the front of the prostate, the patients were enabled to retain their water naturally, the urethra in front of the perineal outlet being permanently obliterated. Probably in these instances the compressor muscle may have regained its command behind the artificial opening, though this need not be regarded as essential. In cases of extravasation of urine, treated by free incision, when a catheter is not employed to mar the healing process, I believe it will be found that the urine always escapes into the poultice at intervals and not by continued dribbling; unless indeed the bladder becomes distended, which very rarely occurs.

Retention is a consequence of lesion of the brain or spinal cord, either suspending all voluntary power or cutting it off from the bladder. In compression of the brain the retention is more or less positive in accordance with the intensity

of the coma ; in compression of the cord, as from fracture, where the paraplegia is complete, the bladder is absolutely inactive. This latter condition seems suggestive of the entire insusceptibility of the bladder to reflex influence when cut off from the source of sensation and volition ; but Mr. Savory has directed attention to the fact that the violence and shock inflicted by crushing the cord has the effect of diminishing its reflex sensibility below the injury.¹ Indeed, this observation is confirmed by other experiments in such cases, designed to test that susceptibility in the lower limbs : the response is feeble, and becomes increasingly so as life wanes, though the functions of the brain may retain their activity in parts above the seat of injury. It is said that the bladder, in cases of compressed cord, will sometimes expel the urine by reflex action. I cannot say I have ever seen this exemplified. Occasionally a full bladder may, in the act of coughing, eject some of its contents, when the injury does not involve the nervous supply to the abdominal muscles. It is also said that a dog has urinated naturally after section of the cord in the dorsal region. I can believe that, the cord being divided by a clean cut and without further shock, the reflex nerve-force supplied to the bladder might suffice to excite an apparently natural ejection of the urine : but I suspect this was an exceptionally successful experiment.

I will finish with two or three supplementary observations, before I proceed to make some remarks on the sphincters of the rectum.

The sensation of a desire to pass water is an appeal to the sensorium ; and this, as I believe, implies an act of volition in the effort that follows. The necessity for this appeal, if the consequent act be purely reflex, is not apparent, except it be as a warning to the will to restrain it. I apprehend that the condition of the muscular coat of the bladder, as regards its innervation, resembles that of the ordinary voluntary muscles. The muscular sense conveys information to the sensorium on which the will acts ; in like manner the sensation of a desire to micturate is the centripetal appeal to the sensory ganglia of the brain, which excites the agency of the will ; and the allied motor ganglia supply the force

¹ 'St. Bartholomew's Hospital Reports.'

which is conveyed through the efferent nerves. But in each case the same muscles are also under spinal reflex influence ; yet this does not necessarily imply the existence of two independent circles. On the contrary, there is reason to believe, on anatomical as well as physiological grounds, that the nerve-fibres, both afferent and efferent, communicate with the grey matter of the cord, conveying impressions to it, and receiving energy from it, in their progress to and from the brain.

The urine is retained longer, without distress, in the recumbent than in the erect posture. This difference may be due partly to the absence of tension of the parietes of the abdomen and pelvic outlet when the body is in a state of repose, but chiefly to the gravitation of the urine, and consequent pressure on the sensitive neck of the bladder in the upright position. The desire to pass water, and the commencing effort, are accompanied by a sensation as if there were some relaxation of the outlet. This sensation is referable to the same cause, namely, pressure on the urethral outlet overcoming the passive resistance there. When the act of urinating is begun, the will seems to have but feeble power in controlling its completion, except, as I have already remarked, that the outflow may be suddenly arrested in the male by the accelerator muscle. This lack of restraining power is probably the effect of habit in great measure ; but, the passive obstruction having been overcome, the suspension of the act, without positive control, would naturally be difficult. In women the retaining power is usually greater than in men, and the female bladder is somewhat more capacious ; but both these circumstances are probably the natural consequence of habit fostered by necessity.

Some Remarks on the Sphincters of the Rectum.

The cutaneous sphincter, which may be described as horizontal, though not strictly so, is rounded anteriorly in the female, but pointed in the male, where it is attached to the accelerator urinæ, in harmony with which it acts. It is chiefly a voluntary muscle, but acts also, more or less, under

spinal reflex influence, such action varying in degree according to the position, activity, or rest of the body.

The intestinal or annular sphincter is in constant and vigorous action, under the command of the spinal reflex centre; it is the true guardian of the outlet, being very little under the influence of the will.

These opinions are founded on the following observations and facts:—The cutaneous sphincter resembles, in every respect, the voluntary muscles. It is readily and freely employed at the bidding of the will. Its position and relations are such as to enable it to close the outlet of the bowel, by puckering the skin, as the mouth of a bag is closed, but not so as to constitute, alone, a sufficient security against the escape of its contents, when the peristaltic movement is active.

The vertical plane of fibres, which is just within the cutaneous sphincter, is constituted of a strong annular band of considerable thickness, and of darker hue than the muscular coat of the intestine. This band is not abruptly defined, but mingles with the circular fibres higher up; and the gradual blending in colour of the intervening fibres, which is independent of their aggregation, suggests a mixed character in respect of their function, as associated with this change. The position and arrangement of this annular band, which is uninfluenced mechanically by distension above, is exactly such as to qualify it for the office assigned to it. Its nerve-supply, in contrast with that of the commencing portion of the rectum, is derived chiefly from the sacral branches of the spinal nerves. In texture and appearance it resembles the muscles supplied by these nerves, rather than those under cyclo-ganglionic control.

When the outlet of the bowel is examined, the cutaneous sphincter is found usually not firmly contracted unless irritated: but just within the superficial plane of muscle a rigidly contracted annular band is felt, which seems to be uninfluenced by the introduction of the finger, and to be relaxed only in association with the effort or urgent need to evacuate the bowel (bearing down). Defæcation is completed by its immediate after-contraction. Thus, diarrhœa relaxes this muscle, and calls into voluntary activity the cutaneous

sphincter. In paraplegia from injured cord, although at first the bowel may empty itself unconsciously to the patient, constipation usually follows, due, as I believe, partly to the deterioration of spinal-reflex power in the lower third of the rectum, consequent on the lesion the cord has sustained, and also, doubtless, in part to the inability of the abdominal muscles to assist the expulsive effort, if the injury be sufficiently high up to paralyse them. When arguing, very many years since, in favour of the view that the lower part of the rectum derives special innervation from the spinal centre, I quoted the following experiment, which was performed incidentally when I was engaged, in a very humble way, in assisting Dr. Marshall Hall in his investigations. Having had the entire alimentary canal removed from a horse immediately after death, I remarked that the peristaltic movement, which was vigorous in the small and upper part of the large intestines, became less active in the rectum, until it was scarcely perceptible in its lower part. The contents of the bowel were readily expelled through an artificial opening higher up, by the rhythmic wave, which failed to reach the lowest part of the rectum and force its contents through its open mouth.¹

During defæcation the sphincters are relaxed. This is an associated and necessary condition, which is exemplified in many analogous instances ; notably in relaxation of the pyloric ring when the digested food is urged to apply for a passage through it ; also in the varying condition of the rima glottidis in respiration, in dilatation of the nostrils in dyspnoea, in deglutition, &c.

In connection with this subject, I may notice the apparent anomaly of the inaction of the bladder simultaneously with unconscious evacuation of the intestine in crushed spinal cord, or in compression of the brain. The competency of the bowel to empty itself is often attributed solely to paralysis of the sphincters ; and this is correct so far as voluntary control by the cutaneous sphincter is concerned, but very little otherwise. There is really no anomaly if we consider the source of nerve-force supplied respectively to the bladder and intestine. The latter, except at the lowest part of the

¹ 'Anatomy and Physiology of the Nervous System,' 1836.

rectum, is under the control of the cyclo-ganglionic nerve-centres; and the peristaltic action is, therefore, undisturbed by injury to the brain or cord. It is true that the reflex power of the sphincters is impaired by the violence inflicted on the cord, as already noticed; and, as I have remarked, volition is suspended or annihilated; thus the resistance opposed to the evacuation is lessened. But so long as the lower part of the cord is intact the sphincters retain, to a very considerable extent, their reflex controlling power, though it is insufficient, without voluntary aid, to prevent the expulsive action of the intestine. It is well known that when the lumbar portion of the cord is destroyed,—as is readily shown in a decapitated animal,—all sphincter action ceases.

Should it be asked why, if the annular fibres constituting the internal sphincter are credited with the action ascribed to them, the same office is denied to the muscular fibres similarly related to the neck of the bladder, I believe the foregoing remarks and the general tenor of the preceding pages afford a sufficient answer. The reasons for this distinction may be thus briefly stated—1. The arrangement of the annular fibres of the bladder is not such as to suggest that they are designed for control at the time it is really required, viz. when the bladder is distended. In the rectum the circular fibres of the inner sphincter form around the outlet a more compact and thicker ring, which is undisturbed by the distension of the bowel above. 2. The character of the annular fibres around the neck of the bladder is identical with that of its general muscular coat, and both parts derive their nerve-supply from the same source. The ring around the lower extremity of the rectum is deeper in colour, and, instead of being supplied from the cyclo-ganglionic system, receives its principal innervation from the spinal centre. 3. There is very little need for active or muscular control at the neck of the bladder, the hydrostatic law alluded to sufficing to resist, passively, very great pressure. In the rectum the necessity for such muscular control is obvious; and especially so as the nerve-force on which the peristaltic action depends is derived from the cyclo-ganglionic system, and is therefore independent of the cerebro-spinal centre.

The following are the physiological conclusions, whether novel or otherwise, which it has been my purpose to establish and illustrate:—

1. The muscular coat of the bladder acts under the government of the will, but is also subject to reflex influence.

2. The abdominal muscles take no necessary part in the expulsion of the urine.

3. In early life the action of the bladder is chiefly reflex, but is gradually rendered voluntary by education and habit.

4. The retaining power of the bladder is due (a) in great measure to the hydrostatic law, in accordance with which the egress of fluid from a reservoir through a small tube is determined; (b) to the elasticity and (?) muscularity of the urethra; (c) to its compression, whilst under the arch of the pubes, by the compressor urethræ muscle.

5. The annular fibres around the neck of the bladder have not a sphincter action.

6. Incontinence or retention of urine may be referred to excessive or deficient sensitiveness of bladder, ill-regulated control, atony, mechanical obstruction. When violence is inflicted on the nerve-centres,—either brain or spinal cord,—the bladder may be rendered partially or wholly incapable of expelling its contents. In lesion of the brain this incapacity is proportioned to the profundity of the coma, and due to insensibility and suspension of voluntary power. In compression of the cord the cause is the same, but operates by interruption of the afferent and efferent currents; and the reflex energy of the cord is also impaired.

7. The rectum is guarded at its outlet by two sphincter muscles, one cutaneous and chiefly voluntary, the other intestinal and spinal-reflex. In compression of the brain the former is almost or entirely disabled; in compression of the cord the power of the latter is likewise impaired.

8. Where an appeal is made, through common sensation, to the nerve-centres, it is not consistent with our physiological knowledge to exclude volition from participating in the origination of the motor force which is evoked by that appeal.

In the preceding pages, the nature of my subject has compelled me to assume as probable some things which do not

admit of demonstrative proof; and where this is the case, I have expressed myself accordingly. But if my views are such as to satisfy physiological criticism, I may venture to claim for them the further recommendation that they afford a reasonable explanation of some of the otherwise obscure pathological phenomena presented by the excretory urinary organs.

ON NERVOUS EXHAUSTION AND ON VASO-MOTOR ACTION.

From the 'Journal of Anatomy and Physiology,' vol. xviii, 1884.

NERVOUS exhaustion is an indefinite expression, because it is often used in a lax way ; yet it has a very definite meaning, and signifies a condition which it importantly concerns all, whether physicians or surgeons, to be familiar with in the treatment of disease.

Nervous exhaustion is met with in various conditions of the system, and under different circumstances. Its characteristics and the indications of its presence are by no means uniform. It may be the consequence or cause of physical depression, but the two are always more or less allied. Apart from organic disease, such physical depression as muscular debility or assimilative infirmity is rarely prolonged after nervous renovation ; but exhaustion or its effects, consequent on overtaxed energy of whatever description, often survives the cause.

The meaning of nervous exhaustion I apprehend to be a more or less general depression of vital energy, depending on a failure in the supply of nerve influence, whatever that may be. The battery is exhausted, the electricity is but feebly generated, and the agencies dependent on this supply falter, become erratic, or fail.

This exhaustion may be transient, or it may be enduring or rapidly fatal. Ordinary muscular fatigue from physical exertion, or weariness from mental tension, is relieved by repose of the great generator of muscular and intellectual force. A brief period of suspended activity of the brain in

sleep suffices to restore its generative power for the succeeding day ; for even muscular fatigue means nervous exhaustion, and gains but little, if anything, from repose of the wearied limbs without the renovation of sleep.

The exhaustion may be enduring in proportion to the intensity and endurance of the cause, modified by the temperament and resisting power of the patient. Or, again, it may be rapidly fatal where the conditions for renovation are absent or withdrawn, as in hæmorrhage, and in some forms of injury the effects of which are not directly referrible to shock.

What is the proximate cause of nervous exhaustion ? Probably an insufficient or ill-regulated supply of oxygenated blood to the nerve centres generally : but, except where blood is lost, it is not immediately apparent to what cause such inadequate supply is attributable. We know that the nutrient capillaries are controlled, through the small arteries, by the vaso-motor nerves, and it has been shown experimentally that interference with the nerve current towards the vessels causes their dilatation. But it would seem probable that these nerves influence the vessels otherwise than by stimulating their contraction, viz., by regulating the uniform or rhythmical distribution of the blood. Moreover, there is no doubt that there exists some agency by which the vaso-motor activity may be restrained,—by which, in other words, an inhibitory control over the contractility of the vessels is exercised. This must be in one of two ways,—either by the initiative agency of the brain, or by reflex action. The former mode is exemplified in the emotional act of blushing, or in the influence exercised over the *nervi erigentes*. In both these conditions the vaso-motor influence would seem to be suspended, or modified in such way as to allow of distension of the capillary vessels. If the effect be reflex, as in the early phenomena of inflammation, it would most probably be directly through an afferent and efferent nerve-channel, between the affected area and the source of nerve force, wherever that may be. But other movements, due to the ganglionic centres, may be influenced similarly in two ways. Peristalsis of the intestine may be stimulated by emotion, and the same effect may be produced by reflex

irritation originating in the bowel. Yet it is singular that, in the act of blushing, we are supposing the vaso-motor nerves to be conductors of an inhibitory mandate from the brain, whereas in the stimulation of the intestine we recognise an incitement to increased activity. Possibly the quickened peristalsis may be secondary, and directly due to augmented secretion, consequent on dilatation of the capillaries. Yet again, though the emotion of fear may produce copious perspiration, it is usually accompanied by pallor, which denotes arterial constriction. In truth, many of these phenomena are but ill-understood, and require further elucidation; and this remark applies also to our present knowledge respecting the sources of vaso-motor influence, whether in stimulating contraction or for inhibition, regarding which the results of experiment and observation still leave much in obscurity.

It is probable that the cyclo-ganglia generally are originators of vaso-motor force, as well as similar sources in the medulla oblongata and other parts of the cerebro-spinal centre: but whatever may be the theory regarding the propagation of nerve energy, whether in harmonious or conflicting waves with corresponding results, or in other ways, it is impossible to attach any other than a negative meaning, *quoad* the result, to the term "inhibition," as the vessels can be dilated only by their relaxed condition permitting the blood to accumulate in them. Indeed, it is difficult to conceive how inhibition can be manifested save by a control exercised over the sources of active nerve force: *e. g.*, the cardiac branches of the pneumogastric must owe their inhibitory property to their power of suppressing the activity of the cardiac ganglia, which is probably their destination, and not to any direct control over the muscular structure of the heart. In like manner, as stimulation of the proximal end of the divided cardiac branch of the vagus produces dilatation of the abdominal vessels, we recognise a reflex inhibitory influence upon the semilunar ganglia through the medium of the splanchnics, as it ceases as soon as these last-named branches are divided; and the vaso-motor influence derived from the solar plexus is re-asserted.

There are many conditions under which the vaso-motor

government of the small arteries is modified, but at present it is impossible to classify them. That there is some correlation, in the exercise of control, between the cerebro-spinal and vaso-motor nerves must be admitted; and certain observed facts appear to point to the activity, in an inverse ratio, of the organic and animal nerve centres. Thus sleep, if dependent on constriction of the cerebral arteries, exemplifies this view; in like manner digestion, which is impeded by physical or mental exertion: and the compound act of respiration does not negative the idea. In hybernation the vaso-motor constriction, producing organic inactivity and sleep, is accompanied by absolute rest of the muscular frame, except for the reduced form of respiration and circulation which then obtains; and these are under ganglionic influence. It is also reasonable to believe that any local demand for more or less active distribution of blood is responded to by the nerve centres which supply the area making the demand, and that fatigue or exhaustion may follow abnormal activity in these as in the cerebro-spinal system.

But what is more to the purpose in my present inquiry is the solution of the question, how any organ or tissue is prejudiced by suspended or altered control of the vaso-motor influence. The small arteries possess an intrinsic tone, and evidence of rhythmic variations in calibre, independent of nerve-influence or the heart's action; and their normal condition is that of a certain amount of constriction under the government of the vaso-motor system. Stimulation of this imparted tone implies a consequent excess of the normal state of contraction, and its suspension, more or less, is inhibition. Yet these axioms scarcely suffice to explain satisfactorily many of the phenomena which pathology presents for our notice; and it would seem safer, with our present knowledge, to fall back on the more general proposition, that the vaso-motor influence is exercised in regulating the uniform distribution of the blood. The loss of this important control must materially curtail the healthy tone of the vessels, notwithstanding their recuperative power after such privation: moreover, the normal blood-pressure would be diminished in any area so affected. The consequences of the above sources of disturbance would suffice to account for deterioration of organic

function or of nutrition. Yet there may be another factor in the production of this result. Loss of tone in the small arteries is accompanied by an augmented flow of blood throughout any given area, and a rise in temperature. This would seem to indicate more rapid combustion; and, if unattended by any equivalent in the renewal of tissue, there would be consequent functional inactivity or textural degeneration. If the vaso-motor centres give way under a continuous strain on their activity, or from any other less direct cause, the organs they supply must suffer accordingly. No doubt some of the effects of exhaustion or over-stimulation of vaso-motor energy are witnessed in atrophic and hypertrophic diseases; but the results may be apparent without organic change. The insomnolence of the over-taxed brain of the too zealous student, and the sleepless mania and untiring restlessness of the drunkard are due, though for different reasons, to this vaso-motor exhaustion; and a similar explanation, *mutatis mutandis*, would account for the drowsiness of the sluggard. Degeneration in power of brain or muscle, from disuse, implies defective vaso-motor energy, consequent on restricted demand, and its necessary concomitant, insufficient blood supply.

I have said that nervous exhaustion is witnessed in various conditions of the body, and under different circumstances. A few instances will serve to exemplify these. A severe form of headache is accompanied by distension of the arteries of the scalp. Whether or not this vascular repletion is the cause of the suffering, it indicates suspended tone in the vessels affected, and is attended by disturbance in other parts of the circulation from deranged blood-pressure, as evinced by cold hands and feet, &c. Exertion under these circumstances prolongs the suffering, though alleviation is sometimes obtained by profuse perspiration; the dilated vessels are thus relieved, and the balance of the circulation is restored.

The effect of a rapid loss of blood is syncope, more or less complete. The proximate cause of this condition is nervous prostration, due to deprivation of blood in the nerve centres. This may be only transient, but it may also be fatal. If recovery follow, the effects of nervous exhaustion are often apparent for a protracted period, and manifest themselves in

various forms of disturbance, according to the idiosyncrasy of the sufferer ; and in some instances where the loss of blood has been only moderate. An analogous condition is witnessed in copious and protracted suppuration. Prolonged and severe pain is also an exhaustive ; and so likewise are attacks of acute localised inflammation, directly as well as indirectly. Many chronic diseases exhibit their exhaustive influence on the vaso-motor centres by the impoverished nutrition of the frame ; and a similar effect is produced by the strain of protracted mental emotion. Privation of sufficient nutriment acts in the same way ; and this, when conjoined with excessive exertion, either physical or intellectual, often leaves an abiding effect on all the centres of nerve influence, in some cases inducing insanity.

In all the above-named conditions the value of repose and of plenty of oxygen and of ozone is recognised equally with that of nutritious and easily assimilated food. But the beneficial agency of stimulants, as such, is more than questionable ; I believe that, except in extreme prostration, they are generally prejudicial.

There is, necessarily, a close alliance between nervous exhaustion and shock ; but there is, at the same time, a distinction between them. Shock is the immediate effect of a suddenly operative cause, from which, if not fatal and there is no organic lesion, the nerve centres quickly rally ; where there is organic lesion, as in ruptured viscus, the shock becomes merged in nervous prostration, which continues although local inflammation may supervene. That simple shock is sometimes immediately fatal there can be no reasonable doubt ; but where such is the case, death is due to the strong impression on some of the nerve centres, not necessarily the brain. The symptoms described as characterising cerebral concussion are to a great extent attributable to shock. In like manner a blow on the neck or in the epigastrium may destroy life instantaneously by paralysing the cyclo-ganglia in these regions, either directly, or mediately through the reflex circle of the vagus, medulla oblongata and splanchnic nerves. Post-mortem appearances favour either interpretation ; for the thoracic and abdominal viscera—especially the latter—are found loaded with blood, whilst the surface is

blanched. The treatment, where time is allowed, should be directed to stimulating the medullary source of vaso-motor force, as well as to relaxing the constriction of the cutaneous vessels. In the collapse of cholera, resembling shock, the same condition of the abdominal vessels obtains, suggesting that the solar plexus is paralysed, probably through the intermediate influence of the vagus, by the poison ; and that its elimination, if such it be, by the intestines, is the direct consequence of the accumulation of blood in their gorged vessels. What vaso-motor constrictor would stay this fatal flux ? In the answer to this question we may find the means of tiding over the crisis of this unmanageable malady ; but this must be by an appeal to the medulla oblongata.

It should be further remembered that nervous exhaustion is a condition favouring the assault or development of any disease, whether functional or organic, to which a patient may be prone. Illustrations of this are of daily occurrence in practice. Rheumatism, gout, ague, various forms of dyspepsia, &c., invade their predisposed victims when in a state of nervous exhaustion, and this after the lapse of a very long interval succeeding the primary attack. Even suppressed syphilis will again assert itself ; and latent, or assumedly latent, organic disease, such as cancer and consumption, becomes developed under similar circumstances ; perhaps especially so when the exhaustion which predisposes to such evolution is due to moral more than physical causes. The depressing influence of emotion, such as fear, in favouring the development of disease is a similar fact ; it was exemplified, in very many instances, during the prevalence of cholera in this country.

It may be said that the preceding remarks merely embody that which is well known under a different title. This may be so, yet if the interpretation of the facts be correct something is gained by a recognition of the pathological relation between cause and effect. A more exact knowledge of the physiological cause of changes we witness in disease, and of their *modus operandi*, cannot fail to aid us in the treatment, both curatively and by anticipation of probable consequences.

There is one form of nervous exhaustion which would seem to be common—I had almost said fashionable—if we may

judge by the frequency with which we hear it popularly quoted : yet I think it very doubtful whether this condition, viz. collapse of brain-energy from overwork, ever exists *per se*, i. e. so long as the ordinary rules of hygiene are not set at defiance. At any rate it is rare to hear the complaint coming from our deepest thinkers, our most prolific authors, our most diligent workers in science and literature. The fact is, that the condition attributed to brain exhaustion is really due to general nervous prostration, consequent on inattention to the elementary laws of health. Close rooms, neglect of exercise, encroachment on the hours of rest, combined probably with irregular meals and recourse to the artificial stimulus of alcohol, are conjointly sufficient to produce the state I have been considering as exhaustion of the vaso-motor centres. And it may be remarked that the moral influence of anxiety is a factor of no small importance in producing this result. I am informed that Dr. Forbes Winslow once observed to a friend, that overwork of brain never alone produces insanity, but that anxiety and worry often do. The foregoing remarks apply with less force to the very young of delicate and susceptible temperament.

Hysteria appears to be closely associated with primary disturbance of the vaso-motor nerve centres. Many of the anomalous symptoms it presents may be thus explained, without crediting the uterus with any agency in their production. That some other explanation than that of uterine derangement must be sought in many instances is apparent from the fact, now fully recognised, that the same train of symptoms which characterise the disease in the female may be present in the male ; and it is time that this nomenclature should be replaced by a comprehensive word, etymologically correct, and more expressive of the real nature and extent of the disturbance, such as *Neuro-cachexia*.

Another form of nervous exhaustion, more commonly exaggerated and assumed than real, is that which is attributed to shock from railway accident. In most instances it seems to be now recognised that the theory of organic mischief to the spinal cord is rarely tenable, as an explanation of the condition in which the subjects of these accidents find themselves, after the immediate effects of the shaking to which

they have been exposed have passed away. No doubt some of these cases are genuine, and the symptoms observed can be explained only by special derangement in the functions of the vaso-motor—indeed of all the cyclo-ganglionic—centres, either primary or consecutive. They are, usually, insomnolence or restlessness, confused dreaming, lack of appetite, dyspepsia, constipated bowels, general languor, with mental and physical disability. To these may be added other complaints more directly referable to the cerebro-spinal centre, viz., local or general hyperæsthesia, numbness and formication, tenderness specially located at some part of the spinal column, imperfection of memory, eyesight, or hearing. In more serious cases there is cramp, defective sexual power, giddiness, and imperfect co-ordination of muscular action in walking. A combination of many of the above symptoms is very suggestive of hysteria; and this circumstance renders it very difficult to attach a definite value to the complaints of patients. These cases are, in fact, so complicated by extraneous influences, that they require both patience and sagacity, aided by experience, to unravel them. The common practice is to enjoin absolute rest both of body and mind, together with a generous diet, tonics, and perhaps stimulants. The usual effect of such treatment is to aggravate many of the symptoms, by rendering the patient more dyspeptic and hypochondriacal, and by nursing the belief that serious illness exists, which the prospect of substantial pecuniary compensation naturally fosters. Leading questions elicit corresponding answers, and the imagination is thus brought into play. Moreover, all the usual subjective symptoms which are required to make up a case are now so popularly known, that designing patients, especially of the neuro-cachectic type, have no difficulty in satisfying themselves, whilst they impose even upon their medical attendants. In this way it is that the medical evidence in these cases is so often contradictory, and both judge and jury are perplexed if not misled; the ends of justice being thus thwarted by the impossibility of proving the knavery of a dishonest claimant.

Instances are not uncommon of collapse, rather than exhaustion, of brain-force, from disuse of the organ. This is

witnessed in those who abruptly withdraw from a busy, active life, which had yielded but little variety except in the degree of excitement their calling may have afforded, and whose limited resources outside their occupation supply no substitute when that calling is laid aside. How many there are whose lives are abridged by such sudden change of habits, when they have not the power or the will to accommodate themselves to their circumstances by adopting fresh employment : a sad sequel to years of unremitting toil. The mental prostration to which I refer may endure for a considerable time without much variation ; but it is more commonly progressive, and may involve loss of memory and other faculties, or terminate in imbecility and death. In some instances these stages are passed through much more rapidly than in others. What is the rationale of this condition, pathologically considered ? It appears to me that it is probably attributable to the sudden and complete withdrawal of the wonted stimulus to the vaso-motor nerves supplying the cerebral arteries ; whereby the brain, previously well nourished, becomes impoverished, and its functions are impaired and gradually lost. The physical change of the brain, misnamed softening, would be included in this category, and may be explained in the same way by the deteriorated function of the vaso-motor nerves, in the regulated distribution of oxygenated blood. The brain ceases to solicit its wonted supply, and is consequently enfeebled and starved.

It is difficult to exhaust such a subject as the present, from which so few pathological changes can be excluded. Certainly all conditions which involve localised quantitative changes in the circulation must be included. The phenomena of congestion, simple hyperæmia and inflammation must be studied by the light of the vaso-motor influence. The agency of stimulants in promoting granulation may be accounted for by the demand which is thus made on these nutrient nerve centres ; and so likewise the beneficial effect of local blood-letting and of counter-irritants.

There are, also, many other circumstances, in which exaltation of function may be explained by excessive activity of the nutrient vessels, implying a corresponding condition of the vaso-motor nerves. This may occur in a particular set

of muscles, or in some part of the cerebro-spinal centre, or in any of the glands, such functional exaltation, whether from choice or necessity, inviting a regulated increase in the supply of blood; and this appeal is responded to by the vaso-motor centres, and the required impulse is conveyed through the efferent nerves. In this way either augmented functional activity or textural hypertrophy may be produced. Curable forms of insanity are probably attributable to this localised functional activity, for which diversion of the mind to other subjects of thought and occupation has been found so efficacious a remedy. Many organic pathological changes, atrophic as well as hypertrophic, admit of a similar interpretation; and there are but few functional disorders which are not indirectly associated with, if not actually dependent on, the agency of the vaso-motor nerve centres. It is unnecessary to pursue this branch of the subject further, as light has been thrown on many of the conditions referred to by various experimental physiologists and pathologists.

In the treatment of nervous exhaustion it is of course essential to ascertain its real cause, whether physical or moral, proximate or remote, with a view to control its influence, or, if possible, to remove the patient from the sphere of its operation. A rational view of the actual condition must likewise be studied, in order to avoid the indiscriminate, and often senseless use of remedies, which are supposed to be appropriate in debility, loss of flesh, and lack of appetite. High feeding, stimulants and tonics are popularly credited with the character of specifics in such cases; yet they are often prejudicial, and in some cases seriously so. We do more good by supplying some element which is deficient in the system, or by correcting some defect in the organic chemistry of assimilation, or removing some source of irritation. Many selected articles of food fulfil these conditions; other desiderata are realised medicinally by such agents as the mineral acids, quinine, soluble forms of iron, the salts of potash, especially the chlorate, and other preparations which possess a special reputation as nerve tonics. If these are largely diluted, absorption is more certainly secured, and irritation is averted. Dietetic study, combined with regularity in food and exercise, are of course essential.

Although the importance of avoiding all sources of exhaustion, especially in severe injuries or operations, is self-evident, it is not always sufficiently insisted on. The depression succeeding even temporary excitement or exertion, in an enfeebled and susceptible frame, is often followed by an apparently disproportionate degree of exhaustion, which may seriously endanger the patient's life. A more accurate recognition of the physiological cause of this result should secure a more scrupulous attention to the necessary precautions in these circumstances. We watch and guard against the effects of abnormal excitement in the reaction following shock ; but the exhaustion consequent on ill-timed excitement is more often productive of mischief, though its cause may be unknown to or not guarded against by the medical attendant.

In attempting an explanation of certain pathological changes and the action of therapeutic agents, it is desirable to review the ground on which we stand.

1. I assume that the normal tone of the arteries may be augmented or diminished within limited bounds, without such variation constituting a deviation from the standard of health, unless unduly prolonged.

Beyond such limit of intensity and duration, either functional or organic derangement, atrophy, or hypertrophy result.

2. That persistent constriction or dilatation of the small arteries is equally the cause of mal-nutrition ; in the former case by limiting the quantity of blood circulating in the affected area, in the latter by the overcrowding of the vessels and the excess of carbonic acid evolved in the capillaries.

3. That the contraction of arteries when normal is intrinsically rhythmical, but that abnormally it may become intermittently or continuously spasmodic, or it may be restrained or wholly suspended.

4. That capillary obstruction, when it exists as a primary condition—as easily seen in the web of a frog's foot when irritated—is due to a disturbance of the vital correlation between the blood and its channels ; but it is very questionable whether capillary congestion is the consequence of arterial constriction, though it may produce it, or that the accumulation of dark blood in the capillaries, from whatever cause, implies arterial tension.

These considerations refer chiefly to the physical control exercised by the vaso-motor nerves; but their far-reaching influence in the realms of organic life may include biological consequences, with which our present knowledge has not made us acquainted.

Variations in the temperature of the body occur under various circumstances. In most instances there is an intelligible explanation of these deviations from a healthy standard, but for some no satisfactory reason can be assigned. Whatever may be the ultimate cause of a rise or fall in temperature, there can be no reasonable doubt that a change in the vascular tension, due to the vaso-motor influence, is the proximate agency by which these changes are produced. Symptomatic fever, of whatever type, is characterised by a rapid and vigorous circulation, and consequently quickened respiration. The evolution of heat is, therefore, more abundant in the capillaries. In the cold stage of intermittent this state is reversed. In very high temperature—and I have known it rise to 110° —the evidence of nervous perturbation and excitement is always more pronounced; and this is both the cause and the consequence of a loss of balance in the circulation, which together place life in imminent peril. Functional derangement, involving the nervous centres, may cause a rise in temperature of several degrees, and prove as transient as the cause. It is interesting to notice how small patches of congestion appear on the surface and fade without any apparent cause. This must be produced by the suspension of vaso-motor influence in the limited areas so affected. In the absence of capillary obstruction the thermometer is a gauge of the rhythmic activity of the arteries, and therefore of the vasomotor centres.

The contrast between what may be called (to use somewhat obsolete terms) healthy and unhealthy inflammation, is an interesting study; for whatever may be the theory founded on any particular definition of that word, there is no doubt that practically there are conditions presenting all the sensible phenomena of inflammation which tend, some to repair and others to destruction. The advancing condition of the affected areas is very different in these several circumstances, apart from their intrinsic vitality or the state of the blood

circulating in them. In the destructive process, the primary dilatation of the small arteries is augmented and perpetuated : the vaso-motor action is suspended, and the blocked capillaries and their contents die, the early increased flow of blood to the part simply accelerating this result. But in reparative inflammation the vaso-motor control is reasserted, fresh channels are developed for the blood to flow into, and the abundant material is utilised. Ulceration, abscess, phagedena, exemplify these conditions in their earlier and later stages. In senile gangrene the intrinsic tone of the arteries, as well as that derived from the vaso-motor nerves, is extinguished, and thence the loss of vitality. The influence of a powerful stimulant, such as nitric acid, in arresting rapidly spreading ulceration, must be due to the strong appeal made to the nerve centres. It would be fruitless to invoke such an effort in a limb, of which the arteries are rigid tubes. A transient state of congestion, which is not dependent on venous obstruction, is but a modification or arrested evolution of inflammation, and may be explained in the same way. This is often witnessed in these affections of the lungs ; and the suggested explanation may account for the anomaly which a comparison between the former and modern treatment of pneumonia presents. Venesection was a rough and ready method of restoring the disturbed equilibrium of the circulation, leaving the patient, if saved, to struggle back to health as best he might. More trust is now placed in nature's recuperative power ; and stimulants, with counter-irritation, aid the vaso-motor power to re-establish the lost balance without depletion.

The effect of blood-letting or counter irritation may be partly ascribed to the relief afforded to the local vascular repletion ; but probably chiefly so, especially in the use of the latter remedy, to the stimulus thus imparted to the vaso-motor centres. The abstraction of blood tends, no doubt, in some instances, materially to rectify the disordered blood-pressure.

Surgeons are familiar with the value of both heat and cold in the treatment of local inflammation. Where there is evidence of much congestion, warmth and moisture are preferable ; but in other cases the continuous—not intermit-

tent—employment of cold applications is generally more beneficial. How does this “blowing hot and cold” for the same end admit of explanation? A cold application stimulates contraction of the small arteries, and thus diminishes the quantity of blood in the affected area. Where moist warmth is used the relief is more directly mechanical. The tissues themselves are relaxed, and exudation is encouraged, as well as cutaneous secretion. The patient’s feelings are often the best guide to the surgeon in making his election between the two in doubtful cases.¹

The shock consequent on severe burn or scald, when not fatal, is often very enduring, and involves the vaso-motor system extensively. No doubt the serious derangement in the blood-pressure is instrumental in producing the collapse, and in favouring the subsequent development of inflammatory attacks of the mucous membranes.

Exposure to a sufficiently low temperature, for a long time, produces pallor of the skin and rigidity of the muscles farthest removed from the heart. This is accompanied by numbness and succeeded by torpor, terminating in coma and death. The symptoms which usher in the fatal issue very closely resemble those which characterise poisoning by alcohol or a narcotic; and are apparently attributable to the same proximate cause, viz., the accumulation of dark blood in the brain, and, consequent thereon, the gradually declining sensibility of the lungs to the presence of carbonic acid. The pallor and muscular rigidity must be due to the exclusion of blood from the capillaries of the skin and of the muscles: and this, in turn, is dependent, at least in part, on the extreme contraction of the small arteries, under the appeal to the vaso-motor influence. The feeble generation and unequal distribution of animal heat, under these circumstances, together with the abnormal vascular tension, must aggravate the condition and hasten the fatal result. The chief appearance noticed, *post mortem*, is much congestion of the internal organs, especially of the brain. The invigorating effects of moderate cold is a response to a healthy stimulation of the vaso-motor nerves.

The poisonous action of *Alcohol* is expended chiefly on the

¹ For further remarks on this subject, see p. 97.

brain and lungs, which in fatal cases are found deeply congested. This result is such as might be anticipated, from the pneumogastric being the centripetal nerve, and the centre of the reflected vaso-motor nerve influence being the medulla oblongata. When the dose is large the effect is very rapid. One instance came under my own notice in which the victim sucked spirit from a cask till he dropped, and was brought to the hospital in a state of profound coma, surviving only a short time. The exhilaration produced by a moderate quantity of alcohol is due, at any rate in some measure, to stimulation of the vaso-motor centres, and this is especially noticeable where there has been previous exhaustion. But when more is taken, the exaltation of brain function passes into the stage of delirium and loss of co-ordinating power, and thence to stupor. This is quite consistent with the *post-mortem* appearance in fatal cases, and indicates the gradual suspension of vaso-motor control, and the accumulation of dark blood in the dilated capillaries, which the sluggish circulation in the pulmonary vessels and the feeble respiration favour. The habitual and free use of alcohol, by constant stimulation, enervates the vaso-motor energy and enfeebles assimilation, inducing, in combination with other causes, disease in organs which are compelled to exert abnormal activity to eliminate the poison and maintain the circulation.

In comparing the effects of alcohol with those of extreme cold, we remark that congestion of the brain and insensibility of the lungs to the presence of carbonic acid are the proximate cause of death in both ; but this condition is in each instance brought about in a different way. In poisoning by alcohol and its allies, there seems to be gradual withdrawal of vaso-motor influence, and consequently a congested state from dilated vessels : but the action of cold causes constriction of the vessels on the surface and in the limbs, and thus compels or permits the blood to accumulate in the internal organs, the vessels of which yield to the pressure, and become dilated and obstructed from stasis.

Chloral and *Ether* may be placed in the same category with alcohol, the *post-mortem* examination revealing the same cerebral congestion.

As regards *Chloroform*, when administered by inhalation, it has appeared to me that its deadly influence is, in some cases, negative rather than positive; that its fatality is the consequence of the exclusion of atmospheric air, rather than attributable to the direct impression of the vapour on the nerve centres; unless, indeed, there be some peculiarity in the condition of the patients, from disease or otherwise, which renders them especially susceptible of the poison. That death from this drug may occur from simple apnœa was demonstrated in a case which came under my own observation some years since. I had removed a mammary tumour from an apparently healthy woman of about 35, under chloroform. The wound was dressed and the patient was sleeping quietly, when I observed that she ceased to breathe, though the heart continued to beat. After considerable perseverance, using Marshall Hall's method, natural respiration was restored, and a stimulant was given. But she soon relapsed into the previous condition; and this occurred repeatedly for the space of an hour and a half at least, the same method of resuscitation being resorted to on each occasion; she then recovered. In this case either the reflex action of the phrenic nerves must have been inhibited, or the susceptibility of the lungs to the presence of carbonic acid must have been suspended. Fortunately the heart's beat was not interrupted. The intoxication caused by inhaled chloroform often resembles that of imbibed alcohol, in its progressive stages to transient coma. In some instances they cause death in the same way, by producing congestion of the brain and lungs, as manifested during life and after death; but there can be no doubt that the fatality of chloroform is more often due to its reflex inhibitory impression upon the heart,—the pneumogastric being, in that case, both the afferent and efferent medium of communication.

Opium and other allied narcotics act by paralysing the vaso-motor and respiratory centres; and the fatal stupor and tendency to apnœa can be averted only by rousing the patient to voluntary acts of respiration.

The active principle of *tobacco* produces its deadly effect in the same way, congestion of the brain and lungs being the most noticeable *post-mortem* appearance.

As the intestines are under the control of the ganglionic nerves, the action of *aperients* would appear to be due to the appeal which is made to the ganglionic centres. Some laxative drugs stimulate the peristaltic movement; others act by increasing the secretion of the mucous surface, which is determined by the augmented local activity of the circulation. The reflex action of many drugs on the intestines may be thus interpreted; the value of opium in controlling diarrhœa, and in relaxing spasm in constipation, may be explained by its influence over the vaso-motor and musculo-motor nerves.

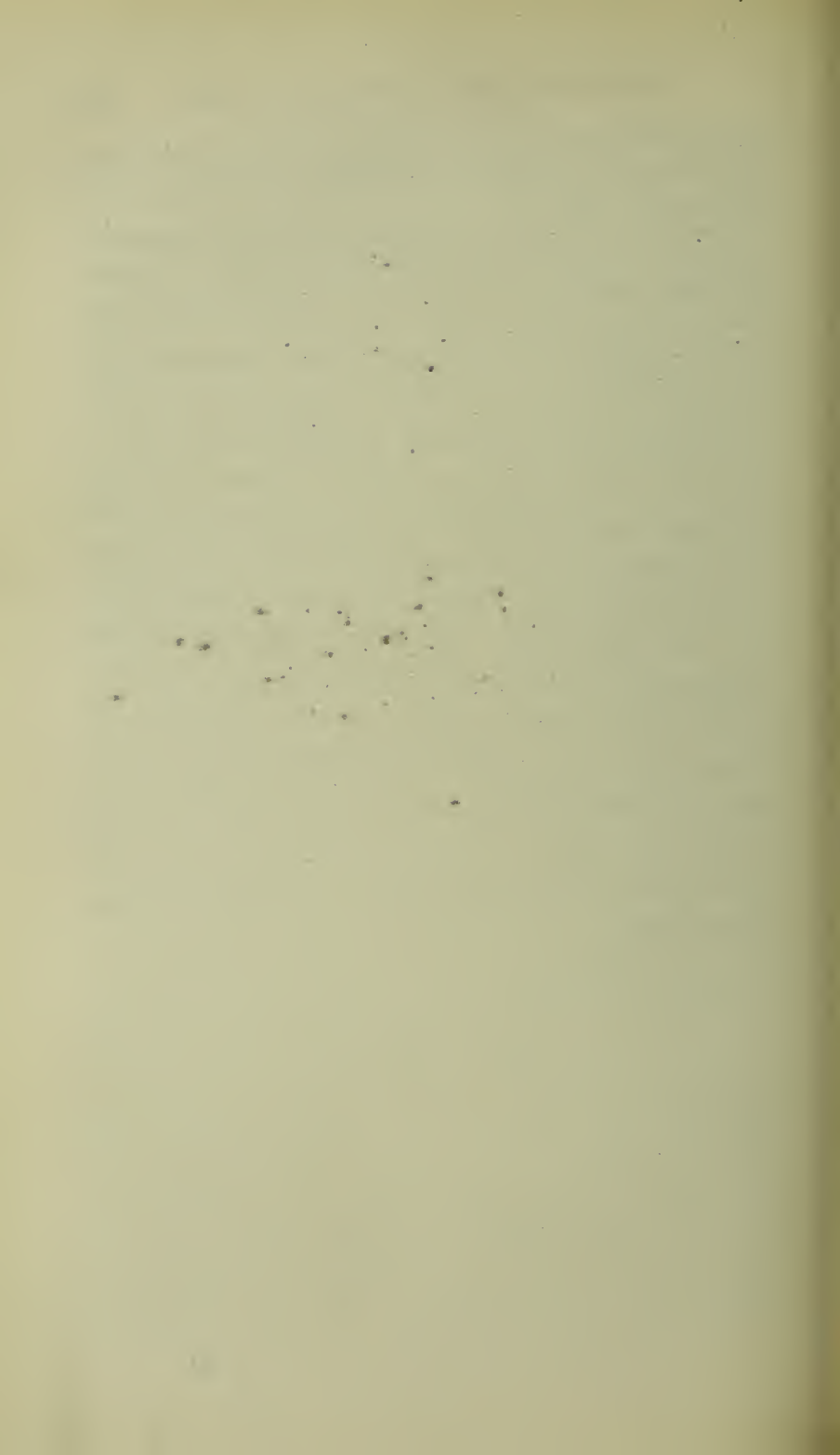
Tea—especially green tea—and *coffee* stimulate the flagging vaso-motor activity; in this way they are beneficial in headache accompanied by dilated arteries. *Guarana* acts in a similar way. This action of coffee is exemplified in narcotic poisoning. The wakefulness produced in some people by the two above-named beverages must be due, I presume, to the increased activity of the circulation in the brain which they occasion; the stimulus, in health, being insufficient to cause that degree of contraction of the cerebral arteries which is supposed to induce sleep. *Nitrite of amyl* causes dilatation, by subduing the vaso-motor energy.

The action of *digitalis* on the heart would seem to indicate a special control over the vaso-motor ganglia which supply this organ. Possibly, however, the influence of this drug may be more general; and it may be that its power of moderating the heart's action is due to the more uniform and regulated distribution of the blood-pressure. By controlling the abnormal activity of the vaso-motor system, and thus regulating the blood-pressure, the beneficial effect of *digitalis* in large doses, in drunken delirium, admits of an explanation, if this hypothesis be conceded.

The *modus operandi* of *mercury* and *iodine* in stimulating absorption is an open question. It may be through the blood-vessels or through the lymphatics. The former solution seems to be more consistent with our present knowledge on the subject. By controlling the nutrition of a given area, structural growth may be encouraged, or waste of texture favoured, without any necessary interference with the normal activity of the absorbents; indeed, we have no reason, physiologically, to regard the lymphatics as other than passive

tubes under the government of physical laws. Pressure promotes absorption, chiefly by abridging the nutrition of the area pressed upon.

It would not be difficult to multiply instances of the assumed influence of drugs over the vaso-motor system of nerves. That their action would vary under different circumstances, and with the existing condition of the nerve centres, whether normal or disturbed, is to be expected ; and thus some apparent contradictions may be reconciled by reflection and observation. I would, however, in concluding these observations, guard myself against the imputation of assuming to enunciate what has not been already discussed by pathologists as well as physiologists, or of intending to attribute all I have described exclusively to vaso-motor disturbance. "Qui nimium probat, nihil probat." The functional relations which pervade organic life, and which are especially obvious in the interdependence of the various nerve centres, forbid any such rash assertion. My purpose has been to indicate suggestively, and to adduce familiar instances of, the important control which the vaso-motor system exercises in the manifestation of various pathological phenomena, as well as in the cure of disease. I venture to think that a more general recognition of this fact, and the study of therapeutics in the light it seems to afford, may enable us to explain some things we already know empirically, and also help to place the medicinal treatment of disease on a more scientific basis.



SOME REMARKS
ON THE
VENEREAL DISEASE,
CHIEFLY IN REFERENCE TO ITS EVOLUTION.

I HAVE read Mr. Hutchinson's Lettsomian Lectures on Syphilis,¹ and, I need not add, with interest; for everything that Mr. Hutchinson writes repays a thoughtful perusal. There are points in these lectures which recall a very early period of my career, when, as an articled pupil of Mr. Travers, I was engaged in assisting to collect materials for his address to the Hunterian Society, at the close of his year of presidency. His subject was the Venereal disease, in the broadest acceptation of the term. This address was published, though I believe its circulation was limited; and I have a copy before me, presented by the author, in acknowledgment of the trifling help I was, as a youth, privileged to afford my honoured master.

Mr. Travers's first proposition is, that the secretion of an inflamed mucous membrane is competent to excite a similar condition in a healthy mucous surface with which it is brought into contact; and this he illustrated by examples of inflammatory leucorrhœa causing suppurative ophthalmia in newly-born children, and even purulent discharge from the male urethra. There is, no doubt, more susceptibility to such infection in some individuals than in others, as is exemplified in the communication of gonorrhœa; and this is probably

¹ Published in the 'British Medical Journal,' 1886.

even a more potent factor in the issue than the virulence of the secretion. I may add that the specific nature of gonorrhœal ophthalmia is, at least, questionable. I have certainly seen as fatal consequences from suppurative ophthalmia, occurring where there was no suspicion of specific infection.

The next step considered by Mr. Travers is the production of a sore. This condition, as he argued and as I apprehend few will question, may result from the simple application and retention of gonorrhœal matter from the vagina on an excoriation or cutaneous crevice of the glans penis or prepuce. The secretion from the ulcer consequent on this lesion may, when absorbed, infect the system, producing mild secondary symptoms, manifested chiefly in the throat and on the cutaneous surface, and sometimes affecting the joints.

The more virulent form of primary sore—the excavated ulcer with hardened circumference—Mr. Travers regarded as a constitutional sore, the product of a system already impregnated with poison; or, to use his own words, “a gonorrhœal sore in a fresh subject produces, by absorption, constitutional symptoms of the first order (those referred to above); and communicates a similar sore, having the same tendency to propagate the first order of symptoms. But a gonorrhœal sore, occurring in a person already the subject of the first order of symptoms, becomes a constitutional sore, and secretes a matter capable of producing the second order of symptoms (those from hard chancre) in the individual, and of communicating the matter of chancre to another.” Of course Mr. Travers meant that this is the way in which a chancre was originally, and may still be, produced; and no doubt individual susceptibility greatly influences the result. Probably also the maximum of intensity of the poison is not reached until it has passed, under favouring circumstances both constitutional and antecedent, through several individuals.

These views were not original; for Hunter, as is well known, regarded gonorrhœa and syphilis as modifications of one and the same poison. But I suppose Mr. Travers thought it desirable to recall public attention to these opinions, whilst he illustrated the views he entertained by his own experience.

There are some points in connection with this subject on which I will venture to make a few remarks, more in the form of suggestion than of authoritative opinion, and certainly not in a spirit of controversial criticism; for I must candidly admit that I have not at hand any statistics sufficiently comprehensive to carry weight; and I am aware how little value is attached—and perhaps justly so—to opinions thus unsupported.

First, concerning what is generally understood by constitutional influence. This is exemplified in numberless ways in modifying the characteristics of disease; and I can see nothing extravagant in the supposition that a simple inflammatory product may be thereby converted (to use Mr. Hutchinson's word) into a specialised form of disease; and again that this specialised form should, in course of time, assume a specific type; more permanent in character because it has reached its maximum development in that particular direction. In such evolution time is an essential ingredient; as well as the character of the infecting matter and the susceptibility of the recipient; both of which are dependent on inherited or acquired diathesis. This is exemplified in the circumstance that two individuals, deriving syphilis (I use the word in an extended sense) from the same source, are not necessarily affected to the same degree, or even in exactly the same way.

The study of ordinary septic inflammation from decomposing or diseased animal-matter affords an analogous illustration; the susceptibility of the recipient greatly influences the result. Here likewise, as I know by repeated personal experience as well as from observation, there is a period of incubation (if I may so term it) before what may be regarded as the zymotic action commences. In these instances the interval is short compared with that in the case of most specific poisons, perhaps because the affinity between the poison and the circulating fluids is closer in the former than in the later. But the period of incubation, in what are termed specific diseases, is not such as to admit of their being thus classified under one general law. It is true that some of the exanthemata are approximately regular as regards the interval between exposure to infection and the

manifestation of disease ; but they differ in this respect from one another. Yet I think that in a few, as probably in syphilis, there is a direct ratio between the virulence of the poison and the length of time it is present in the system before it is developed. Certainly a chancroid (by which I mean a soft sore) has a shorter period of incubation than a chancre ; and I think it a subject worthy of further investigation, whether there is not a more or less regular association between the length of incubation and the subsequent severity of the constitutional affection. That the interval alluded to varies very much in different instances cannot be doubted ; and the simplest, and, as I believe, the true, explanation of the conflicting evidence on this point is afforded by the admission that there are many grades of the same disease ; the mildest of which is developed after a short interval, whilst the severer forms are more delayed ; the intensity perhaps bearing, as I have remarked, a direct relation to the length of incubation. The case of the self-vaccinated medical man, mentioned by Mr. Hutchinson, illustrates the latter class.

My creed, then, derived from observation, is that there may be superficial sores—mere ulcerated excoriations—which heal without constitutional treatment, and leave no after-consequences ; that there are other superficial sores which appear after a varying period of incubation, and, though possessing none of the special characteristics of chancre, namely, induration and exedent ulceration, yet may entail mild secondary symptoms ; that there is a third class, the genuine chancre, with a longer period of incubation, and entailing, more certainly, severer and more complicated secondary symptoms, which are far less amenable to treatment. Between these last two or constitutional varieties of the disease there is no hard and fast line to be drawn ; the gradations between the extremes being many, and determined by circumstances both personal and extraneous, of which the quality of the imparted virus is, perhaps, the most influential. I believe that mercury is competent to save a patient from the constitutional sequences of even a hard chancre ; at the same time I should not feel justified in promising immunity from secondary complications in any case, where even a short

interval only had elapsed between exposure to infection and the local development of the disease; though the sore were superficial and devoid of surrounding induration.

I believe it is an admitted fact that secondary symptoms sometimes occur without any history of primary disease except gonorrhœa; and the suggested explanation is that a primary lesion must have existed out of sight, in some part of the urethra. Now, the phenomena attending the communication of gonorrhœa are more intelligible where the recipient is the female than the converse. The orifice only of the male urethra is exposed; and the canal is not only swept in the act of coition, but frequently irrigated afterwards by the current of urine. How much more difficult, then, it is to conceive that the secretion of a chancre can be conveyed retrogressively along the urethra for some distance, so as to produce a sore by direct contact; it is not even helped by ciliary movement. I think that this explanation must be a mistake; and that any sore so existing is simply an ulceration of the inflamed mucous membrane, commencing in the follicles; the induration sometimes felt being inflammatory deposit in the submucous areolar tissue, such as we meet with in the initiatory stage of insidious urethral abscess from a similar cause. I believe that, as there are virulent and non-virulent sores, so there are specific and simple discharges from the urethra; the former alone being capable of entailing after-consequences, either by direct absorption from the mucous surface, or from an ulcerated lesion. I may also remark that the interval between exposure and infection varies in gonorrhœa: probably—but I do not express any opinion on the point—there may be some relation between the latent period in this case also, though not in the same sense, and the poisonous quality of the infecting matter. I may add that I do not remember to have met with any case which suggested to me the presence of a hard chancre in the urethra.

Again, does the quantity of virus, as well as its quality, influence the result? It is said to do so in vaccination, and appears to do so in some specific fevers. In syphilis this inquiry could be answered only by experiment. I am not disposed to attach much importance to this ques-

tion ; certainly quality is more potent in determining the issue.

The presence of syphilis in the system is not unfrequently evinced by the character which a casual ulcer assumes ; one, that is, which is the result of an accidental lesion of the skin : and the secretion from such ulcer would, I apprehend, possess the infecting properties of a primary syphilitic sore. The undesigned experiments supplied by vaccination leave little doubt on this point.

But the introduction of a non-specific poison from an extraneous source is not a *sine quâ non* in the production of septicism ; it may be home-bred : and this fact illustrates, in a remarkable way, the influence exercised by the intrinsic condition of a patient over some trivial exciting cause of mischief, which in a healthy subject would pass almost unnoticed. All hospital surgeons know the class of patients amongst whom they may expect this poison-generating tendency. The discharge from a festering wound not only diffuses its poison throughout the system of the sufferer, but is qualified to impart its fatal virulence to others, when brought into contact with any trivial breach of surface.

I am not aware whether surgeons are generally agreed as to the presence of a breach of surface being an essential condition for the production of a chancre. There is, probably, in most instances, some trivial abrasion or fissure of the skin ; but I do not think this is by any means necessary, at any rate at the time of sexual intercourse. I apprehend that, in the majority of cases, want of cleanliness is sufficient to account for the result without previous lesion of skin. The irritating secretion of a sore, left undisturbed in contact with the delicate surface of the penis or vagina, is competent to do the mischief. The frequency of chancre at or near to the frænum preputii is probably due to slight laceration of this part. The first localisation of the disease at the original seat of lesion, in these specialised or specific animal poisons, is not the less remarkable because it is a recognised fact of every-day occurrence. What occurs in the interval—frequently long—between infection and development ? Is the local activity the manifestation of reaction, or is the constitution unimplicated until after the localised poison is

matured? I am not aware that these questions have been satisfactorily answered; though attempts have been made to solve them by the early destruction of chancre. My own opinion may be expressed by the admission that I have never had faith enough to try this experiment.

As regards the exhaustion of susceptibility to syphilis after the first attack, I believe the solution of this problem must be sought in the consideration of many complex questions associated with the past history of the disease and the antecedent condition of the patient in each case. A mild attack, chancroid, does not secure immunity: probably, as I believe is the case with some of the exanthemata, a severe form is, when really cured, a better but not certain safeguard against a second attack.

An allied question is, whether a strongly pronounced manifestation of secondary symptoms is any security against the later development of internal organic complications. I cannot answer this question; yet I think it not improbable that such is the case, as I am disposed to regard the cutaneous affections especially as, in a measure, eliminative. But here again much depends on the virulence of the poison and the condition of the recipient; and it is very difficult to reach any satisfactory conclusion on an abstract question, where the necessary data are so complex.

Why is a chancre hard in its circumference and at its base; and why does it present that peculiar excavated character under ulceration? I think that analogy will help us, in a measure, to understand these conditions. I may remark that I am scarcely disposed to admit that a chancre is, unless exceptionally, a sloughy sore, as it is often described. Yet this distinction is hardly worth notice, as it is merely one of degree and not of kind. The excavation is usually accomplished by molecular disintegration, that is, ulceration; it rarely attains the state of slough, though more often the rapidity of the molecular destruction reaches the intermediate or phagedenic stage. The plastic infiltration which constitutes the indurated circumference of the ulcer would, but for the breach of surface, include the whole of the local disease, and has its analogue in non-specific inflammatory infiltration under other circumstances; and notably so in carbuncle.

Under the action of the localised specific poison the affected tissue loses its vitality, and disintegration is the result: in some instances this is slow, in others rapid. Mr. Travers speaks of the tempered character of this destructive phagedenic action at the time he wrote, as compared with his earlier experience; and he attributes the improvement to the use of mercury, although, he adds, that has been obtained probably at the sacrifice of vigorous health in the population, consequent on the excessive and injudicious use of this mineral. I think, indeed, I may say that syphilis has lost some of its severer characteristics within my memory; especially in its secondary stage. Exaggerated examples of rupia were of far more common occurrence fifty years ago than they are now: and so, it appears to me, was destruction in the primary sore. This is hopeful as regards the future. I may here venture to eulogise the perchloride preparation of mercury, in combination with bark: and I am old-fashioned enough still to confide in sarsaparilla, given with the perchloride, as best adapted to many cases, in which the disease has reduced the patient to a state of pitiable suffering and emaciation.

Why is mercury so potent an agent in this disease? There can be no doubt that, as a rule, the progressive activity of the syphilitic poison is incompatible with the active presence of mercury in the system. To whatever cause we may conjecture that the expellent agency of the mineral is due, of one thing I may speak with tolerable certainty; namely, that it is not by its swift and powerful operation that the desired result is accomplished; but by the continuous administration of small doses for a lengthened period, extending beyond the external manifestation of the disease, until the latent tendency to its recrudescence is abolished. We should hear less of what are termed tertiary symptoms or remote sequelæ, if this principle received more attention. The inconstancy of the indications, in different subjects, of the active presence of mercury, renders it difficult to establish any rules as to the dose. A red margin to the gums is quite sufficient, but even this may be absent though the mercury is doing its work; and we must be guided rather by the general symptoms. For a long continuance I prefer small doses—say half a drachm to a drachm—of the perchloride

in the day, on which I have known patients thrive and gain flesh. For rapidity of action the iodide is to be preferred.

Of phagedæna I saw a good deal during my early career ; in fact we were then rarely without a case in the Magdalen Ward of the hospital ; for it was almost exclusively among females that it occurred. The type of the disease was so associated with the locality whence the victims came, that they were known as ' Swan Alley ' cases. Mr. Travers gives a graphic description of this disease, and of the class of patients amongst whom it occurred. The locality was near the Docks, and the wretched girls, ill-fed and plied with gin, lived amid filth and excessive debauchery, until their miserable condition compelled them to seek for admission into the hospital. We were not accustomed to regard these cases as syphilitic, but as due to the combination of the causes which I have enumerated. Certainly they did not require, indeed they could not have borne, any specific treatment. Bark and opium, with a generous diet and regulation of the secretions constituted the general management of these patients ; whilst the local treatment usually resolved itself into the free application of strong nitric acid to the ulcerated surface. In most instances if properly applied, after cleansing the ulcer of disorganised *débris*, the effect was rapid and satisfactory, and the healing was often speedy. I have seen a considerable portion of the femoral artery laid bare by this destructive ulceration : yet most of the cases, if uncomplicated and taken in time, recovered under the simple treatment I have described ; and, so far as I remember, without the occurrence of secondary symptoms. I may add that I do not recollect any instance in which the disease spread from one patient to another in our foul ward.

Of the occurrence of bubo in connection with chancre and soft sore, I would only remark that my impression is that enlarged glands are met with as often in one as the other, but that suppuration is more rare in chancre. It might be interesting to ascertain whether this evinced sympathy of the lymphatic glands in any way modifies the later consequences of the disease ; whether the local suppuration is, in any degree, eliminative. I believe it so acts in the case of some animal poisons : for example, dissecting wounds have

usually more serious consequences, that is, more rapid and severe constitutional effects, when the lymphatic glands are not involved, and the poison passes, unchallenged, into the circulation. They appear to arrest or to modify the poison ; and their suppuration seems to act eliminatively.

I think I can say most positively that I have treated many cases of soft sore as the first disease contracted ; that mercury is frequently needed for their cure ; and that they are sometimes very obstinate before they heal.

The doctrine assumed and argued out by Mr. Travers, in reference to the venereal disease, is simply that of evolution, governed by circumstances which are, in great measure, personal, but also dependent on environment. The presence of certain conditions is essential to the production of the disease in any type ; and these are the same that favour its progressive development in its more virulent forms. The conditions referred to would seem to exist especially amid a densely populated and civilised people, whose culture is not measured by the standard of moral refinement or personal cleanliness. Yet, even with these disadvantages, medicine and sanitary measures have done something towards the devolution (I use the word as the reverse of evolution) of the disease, if I may draw any conclusion from the contrast between the more exaggerated forms of syphilis when I entered the profession and those of the present time : for, as regards the treatment of the disease in hospital practice, I cannot say that there is much change of opinion as to the use of mercury since I began to study. It is true that instances of profuse salivation then came under our notice ; but such practice was not initiated nor pursued in the hospital ; and inunction and fumigation were more generally used as the means of introducing mercury into the system. Sarsaparilla had a high reputation, which has since been, as I think, unjustly denied to it : for it seems to be now entirely ignored. The treatment by iodide of potassium dates from a period more recent than that of which I have been speaking : in it we have a very valuable remedy in secondary affections. But such cases as were then of common occurrence are, as I have remarked, according to my observation, comparatively rare now. I refer especially to exaggerated forms of rupia,

phagedenic ulceration of the thigh and abdominal wall, and extensive exfoliation of the skull and other bones ; the last-mentioned having been, as I think, not unfrequently due to the abuse of mercury, especially in strumous patients.

I am free to admit that my opinions on these subjects have been, in a measure, influenced through life by the impressions I received thus early ; and may, therefore, appear obsolete to the present generation. Yet there is nothing irrational or fantastic in the application of the theory of evolution to disease. Time and circumstance are the requirements of the advocates of this law ; and I believe that, with the command of these essentials, a reversal of this process may likewise be accomplished. I may add that there is no inconsistency in this application of the theory of evolution with the assumed germ-origin of many diseases ; for the specific type and virulence of the poison seem to depend more on some occult attribute of the micro-organisms than on any striking variety in their physical development.

The culture of Pasteur is effecting, rapidly and artificially, what Nature, under favouring circumstances, can and may achieve in time. I apprehend few surgeons of experience would deny that simple tumours sometimes assume a malignant character, and that there are various grades of malignancy. We may some day discover how to reverse this progressive order of evolution, and thus solve the great surgical problem of the day,—the cure of cancer.

These may seem flighty speculations to indulge in, without even the plea of novelty to recommend them. But it is, I think, the wholesome tendency of youth to specialise ; and it is the privilege of maturer years to generalise, as exemplified in Mr. Hutchinson's valuable lectures. The time may come when a more enlarged and general recognition of the law of evolution in disease will lead to some unlooked for revelations, and to the discovery of some more efficient means of not only abating the intensity, but of limiting the variety, of infectious and hereditary maladies ; and this must be by denying the requirements of evolution, and favouring those of its reverse.

There surely is no more difficulty in thus simplifying the origin of infectious disease,—for example, in tracing a hard

chancre, with all its constitutional sequelæ, to a purulent discharge from a mucous surface as its progenitor,—than in recognising the alliance between man and a monad. If in each case there are missing links to be supplied, I apprehend they are nearer to hand in the former instance than in the latter.

SUPPLEMENTARY NOTE.¹

IS SYPHILIS INCURABLE ?

As a believer in the doctrine of evolution in its application to disease generally, and especially to syphilis, I am unable to subscribe to an opinion recently expressed that syphilis is incurable. But questions, which depend for their solution on argument supported by facts, demand, first of all, a clear definition of the sense in which the words expressive of the subject in dispute are employed.

How is syphilis to be defined ? Is it to be regarded as a disease dependent exclusively on a poison absorbed into the system, and then manifesting itself locally ? or, in other words, are secondary symptoms to be regarded as the test whether the disease is syphilis or not ? If so, this seems to me to be begging the question, inasmuch as I recognise sores on the genital organs of both male and female, which are contracted by sexual intercourse, and which are not necessarily accompanied or followed by constitutional symptoms. Again, there are sores which present none of the characteristics of the so-called Hunterian chancre, which are sometimes succeeded by mild secondary symptoms, such as a papular eruption and soreness of the throat. Of the curability of these cases I have no doubt, though I cannot produce statistics to prove it.

Further, is it a fact that hard chancre is invariably followed by secondary symptoms ? I believe this is usual ;

¹ From the 'British Medical Journal,' 1889.

indeed, whatever treatment may be adopted, it is most commonly so. Here, again, I must speak from my general impression; and that is that immunity, even under these circumstances, may be obtained by early and judicious treatment.

But does the havoc of this disease depend exclusively on the virulence of the poison? I think not. The susceptibility of the recipient has very much to do with the result. Two individuals may be very differently affected from the same source. Some persons readily contract gonorrhœa, and others not at all. It has appeared to me that the tubercular diathesis favours the virulence of syphilis, and is generally intolerant of mercury.

If the dogma of the incurability of syphilis be qualified by such conditions as I have referred to, namely, a typical hard chancre, occurring in a susceptible subject with some inherited constitutional flaw, and which has been permitted to run its early course without treatment, I think there is much truth in it. But I should be unwilling to condemn all such, though I think comparatively few escape.

One word regarding treatment. I have not learned to confide in iodide of potassium in the primary treatment of syphilis. Very large doses in the secondary forms are, I think, generally useless, and often prejudicial by seriously affecting the general health of the patient. The free dilution of the drug is the best security for its absorption. Mercury is the remedy to be relied on in the primary stage of hard chancre. Its early administration in some form should be adopted, and its action should be kept up by small doses, just sufficient to maintain proof of its presence in the system. This should be persisted in after the sore has healed, at least as long as any induration around its site remains. For this purpose the perchloride is an excellent preparation. I think that those who advocate the administration of large doses of mercury can have but an indifferent idea of what my early hospital experience enabled me to witness some sixty years ago, and that at a time when the more enlightened surgeons realised the hideous effects of combined mercurial and syphilitic poisoning.

I have no hesitation in recording, so far as my experience

enables me to judge, that syphilis presents less virulent forms now than it did at the period to which I refer ; and this I attribute especially, though not exclusively, to the more carefully regulated use of mercury in the primary treatment of the disease.

In order to obtain a satisfactory reply to the question as to the curability of syphilis, it is necessary to have the treatment of cases from the beginning, and to follow them into their sequelæ. This is rarely granted in hospital practice, but more frequently with private patients. As the general result of my observation, I venture to recommend practitioners not to despair, but to use mercury cautiously and persistently, and with due regard to any special idiosyncrasies of their patients, in the treatment of primary syphilis.

SOME THOUGHTS

ON THE

EVOLUTION AND AFFINITY OF DISEASE.

From the 'Journal of Anatomy and Physiology,' vol. xxi, 1887.

THE theory of Evolution, as it is now generally understood and accepted in its application to normal development, demands a similar recognition in the study of pathology ; for it requires no argument to prove that the various indigenous diseases of civilised life are not coeval with man's creation, and that the farther he recedes from a savage state the more complex do the ailments become to which he is obnoxious. The study of pathology in this aspect is not, as it appears to me, one of mere speculative interest, but of possible practical value, the measure of which it would be rash to limit until the field of inquiry it offers has been fairly cultivated in all its details. A more watchful observation of the development of disease, and of nature's methods of relief, and a more loyal reliance on her ability to cure, have already borne rich fruit in the substitution of a rational for the empirical treatment of disease ; and a tardy recognition of the laws of hygiene has tended in the same direction, by denying the necessary conditions of environment for its evolution. It is, therefore, by patient observance of the progressive steps by which various pathological changes are developed, and the retrogressive steps by which a healthy condition is restored, that we may hope to frustrate or modify the former, and to facilitate the latter ; possibly in time even to banish many diseases which are now prevalent.

The investigations to which I refer may be expressed in the following propositions :—(1) That there are affinities between diseases, which though remote may be traced ; (2) that the divergence from a simple type, and the resulting variety in disease, are due to evolution ; (3) that such evolution is influenced or determined by environment, heredity, or accidental or acquired idiosyncrasies ; (4) that the principle of reversion to original type is a valuable guide in the treatment of disease.

No doubt much that may be written on this subject is purely speculative or hypothetical : but the region of speculation is that also of opinion ; and the same objection may be urged against evolution generally ; and time and opportunity alone can show how far such speculation may be justified : for this subject is not one which can be brought to the test of direct experiment. Yet the present state of our knowledge has prepared the ground, and supplied much of the material which constitutes a foundation on which to raise a superstructure of reasonable probability.

During my student life I became interested in the subject of this paper, by having my attention directed to the evolution of syphilis by Mr. Travers, whose articulated pupil I then was. This eminent surgeon and philosophic thinker was an advocate of the unity of the venereal poison, and of its original derivation from an inflamed mucous membrane. I naturally adopted this view ; and the experience of my professional life has confirmed the impressions thus early received. I will state briefly the line of argument pursued in illustration of pathological evolution, as exemplified by the venereal disease ;¹ and then offer a few remarks on the affinity of disease and evolution in pathology generally.

The first proposition is, that the existence of an inflamed mucous membrane is capable of exciting a similar condition in a healthy mucous surface with which it is placed in contact ; as demonstrated by instances of inflammatory leucorrhœa causing suppurative ophthalmia in new-born infants ; and even purulent discharge from the male urethra. There is, no doubt, more susceptibility to such infection in some

¹ This branch of the subject is more fully treated in the preceding paper ; and some passages in it, relevant to the present paper, are here repeated.

persons than in others, as is exemplified in the communication of gonorrhœa; and this receptiveness, whatever it may be due to, is a potent factor in the development of this, as of other diseases. The next stage is the production of a sore; and this, as I apprehend few will question, may result from the simple application and retention of gonorrhœal matter from the vagina on an excoriation or cutaneous crevice of the glans penis or prepuce. The secretion from the ulcer consequent on this lesion may, when absorbed, infect the system, producing mild secondary symptoms, manifested chiefly in the throat and on the skin, but sometimes affecting the joints.

The more virulent form of primary sore—the excavated ulcer with hardened circumference—Mr. Travers regarded as a constitutional sore, the product of a system already impregnated with poison: or, to use his own words, “a gonorrhœal sore in a fresh subject produces, by absorption, constitutional symptoms of the first order (those referred to above); and communicates a similar sore, having the same tendency to propagate the first order of symptoms. But a gonorrhœal sore, occurring in a person already the subject of the first order of symptoms, becomes a constitutional sore, and secretes a matter capable of producing the second order of symptoms (those from hard chancre) in the individual.”¹ Of course Mr. Travers meant that this is the way in which a chancre was originally caused, and may still be produced; and here, no doubt, individual susceptibility greatly influences the result. Probably also the maximum intensity of the poison is not reached until it has passed, under favourable circumstances, both personal and antecedent, through several individuals. The impressions I acquired thus early have been confirmed by subsequent observation and experience, and may be formulated thus, viz., that there are superficial sores—mere ulcerated excoriations, which heal without constitutional treatment, and have no after-consequences: that there are other superficial sores which appear after a varying period of incubation; and, though possessing none of the special characteristics of chancre, namely, induration, and exedent ulceration, yet may entail mild secondary symptoms: and

¹ ‘Observations on the Pathology of Venereal Affections,’ by Benjamin Travers, F.R.S., p. 29.

there is a third class, the genuine chancre, with a longer period of incubation, and entailing, more certainly, severer and more complicated secondary symptoms, which are far less amenable to treatment. Between the last two or constitutional varieties of the disease no hard and fast line can be drawn; the gradations between the extremes being many, and determined by circumstances both personal and extraneous, in which the susceptibility of the recipient, as well as the quality of the virus, plays an important part.

Constitutional tendencies, whether they be such as may be termed accidental, or such as are inherited or acquired, are very influential in modifying the characteristics of disease. This is exemplified in various circumstances and in many ways: and there is nothing extravagant in the supposition that a simple inflammatory product may be thereby converted into a specialised form of disease; and again, that this specialised form should, in course of time, assume a specific type,—more permanent in character because it has reached its maximum development in that particular direction. In such evolution time is an essential ingredient; as are likewise the character of the infecting matter and the susceptibility of the recipient; both of which are materially governed by inherited or acquired diathesis. This is exemplified in the circumstance that two individuals, deriving syphilis from the same source, are not necessarily affected to the same degree, or even in the same way.

The study of ordinary septic inflammation from decomposing or diseased animal matter affords an analogous illustration; the susceptibility of the recipient greatly influences the result. Here likewise there is a period of incubation (if it may be so termed) before the zymotic action commences. In these instances the interval is short compared with that in the case of most specific poisons, perhaps because the affinity between the poison and the circulating fluids is closer in those which are non-specific. But the period of incubation in what are termed specific diseases is not such as to admit of their being classified under one general law. It is true that some of the exanthemata are approximately regular as regards the interval between exposure to infection and the manifestation of the disease; but they differ in this respect

from one another. Yet in others, and probably also in syphilis, there seems to be a direct ratio between the virulence of the poison, as manifested by its effects, and the length of time it abides in the system before it is developed. Certainly a chancroid, or soft sore, has a shorter period of incubation than a chancre; and it is a question worthy of further investigation, whether there is not a more or less regular association between the length of incubation and the subsequent severity of the constitutional affection. That the interval between inoculation with syphilis and the development of the disease varies very much in different instances is unquestionable; and the simplest, and, as I believe, the true explanation of the conflicting evidence on this point is afforded by the admission that there are many grades of the disease; the mildest of which is developed after a short interval, whilst the severer forms are more delayed; the intensity bearing a direct relation to the length of incubation. This suggestion is not inconsistent with the germ theory of disease; inasmuch as we know that time is an essential condition of the multiplication of germs, and possibly also of the augmentation of their virulence, and of that of ptomaines; whereas the relative susceptibility of the recipients would explain the early surrender in some instances, and the more protracted resistance in others, to the influence of the poison. Is it not a rule, subject to exceptions, that the severer the attack in most infectious maladies, the greater the security, after cure, from a second invasion of the same disease? I believe it to be so in syphilis, as in the exanthemata; probably also in carbuncle.

Of the influence exercised by constitutional proneness to disease we have no lack of proof. In some instances this proclivity is exhibited in relation to special diseases, such as catarrh, gout, pneumonia, or bronchitis: in others it may be elicited by parasitic organisms whose spores are present in the atmosphere, awaiting a suitable soil in which to germinate; their activity being suspended until some impairment of vitality or other propitious conditions in their chance habitat favour their multiplication, or, it may be their assumption of a specific character. As regards non-specific poison, its introduction from an extraneous source is not essential to

the production of a septic condition : it may be home-bred ; —a fact which illustrates, in a remarkable way, how importantly the intrinsic condition of a patient, whether natural or acquired, governs the consequence of exposure to any exciting cause of mischief. Hospital surgeons are familiar with the class of patients amongst whom they may expect this pathogenic tendency. The discharge from a festering wound not only diffuses its poison throughout the system of the sufferer, but is qualified to impart its fatal virulence to others, when it is brought into contact with any trivial breach of surface.

When a specific disease is imported by inoculation, its subsequent localisation, after perhaps a protracted period, at the original seat of lesion, is not the less remarkable because it is a recognised fact of every day occurrence. What happens in the interval—frequently long—between infection and development ? Is the local activity the manifestation of reaction, or is the constitution unimplicated until after the localised poison is matured ? I am not aware that these questions have been satisfactorily answered. The early destruction of chancre has been advocated by some surgeons, but with doubtful efficacy. There seems to be a generally received opinion that, in some of the exanthemata, there is a prevailing association between the period of incubation on the one hand, and the duration of infection and the character of the sequelæ on the other, *i. e.*, where the incubation is protracted, the infecting property of the poison is not long retained, and the converse : again, that a short incubation is often succeeded by relapses and more or less persistent sequelæ ; whereas a long incubation, followed by a well-developed illness, is a security against the after-consequences which are noticeable in the other case. My own experience does not qualify me to confirm these views ; but assuming their correctness I apprehend the explanation may be, that there is a limit to the duration of the virulence of the germs in the same nidus ; and that their infecting power is in great measure exhausted by protracted residence, before development, in an uncongenial soil. But where the predisposition is pronounced, the resistance is brief : yet the germ-poison may continue to exert its influence, entailing sequences which are absent, when the

conditions are reversed. That the presence of such predisposition is a material element under the circumstances is demonstrated, not only by experience and observation, but also by experiment on the lower animals, with different doses of the same poison : for, though the fatality of a germ-poison depends, apparently, as a rule, on the quantity introduced into the circulation, it has been observed that the operation of the dose is far from uniform,—a small dose producing severe or fatal consequences in one case, and causing little or no disturbance in another ; as in Koch's experiment with septicæmic poison in a house-mouse and in a field-mouse : and this result can be due only to some peculiarity in the recipient. The action of many medicines, notably of mercury, in various individuals and in different animals, also supports this conclusion. Probably cholera exemplifies the influence of predisposition to the disease more palpably than other epidemics : and the causes productive of the receptiveness are various, and many of them acquired or dependent on race, as exemplified by the sweating sickness in Ireland in the 15th century, to which the English alone succumbed. It was not unreasonable to anticipate, as experiment suggests, that the incubation period is governed, other considerations apart, by the dose of the poison ; *i. e.*, the larger the dose the shorter the interval, and the converse. But here again predisposition must not be lost sight of ; nor must it be ignored that the germs themselves are not uniformly virulent ; both which circumstances materially qualify any conclusions drawn from observations on the relations between the incubatory stage and the quantity of poison introduced.¹

If we say that the effect of a small dose is to diminish or annul any existing susceptibility to a disease, it is simply enunciating, in a familiar way, the doctrine of protection which is now receiving so much attention, and which appears to promise such valuable results. But how this protection is achieved remains a mystery. It must be sought in an explanation of what constitutes the predisposition to a disease ; and this may consist in the presence of some material element necessary to the zymotic action, which, when exhausted by

¹ Mr. Walton Cheyne's Observations ('British Medical Journal' for July 31st, 1887) may be consulted with advantage on these points.

a feeble appeal or by the instrumentality of some nearly allied poison, is not reproduced. The fermentation being completed, the addition of more ferment has no power to regenerate the action. I may mention, in connection with this subject, the statement made on the authority of the British Bee-keepers' Association, that the occasional stings to which bee-keepers are exposed need not be guarded against, as they will cause less and less trouble until neither swelling nor irritation will follow. A practical bee-keeper has assured me that he can verify this statement from his own experience. I am informed, on the best authority, that there are no recorded facts tending to show that any similar immunity is conferred on the subjects of snake-poisoning, if they have the good fortune to survive the injury: but my informant adds that he is not aware that the subject has been investigated;—probably for the valid reason that the paucity of material has prevented it.

There cannot be any reasonable doubt that the absence of susceptibility to a second attack implies some remarkable change in the condition of the individual subjected to infection; a change which converts a fertile into a sterile soil. The barren result of exposure is not due to any impairment of inherent virulence in the specific germs: the same opportunity of infecting the system exists as in the virgin soil; but the conditions necessary for their incubation are absent, or their reproductiveness is extinguished. This assumption seems to be suggestive of a concert of conditions, as essential to the activity of infection: in other words, that the parasites are not, *per se*, actively infectious, but require some corresponding or adjusted state of the recipient to excite their specific activity or to stimulate their reproductiveness: this not being present, they remain innocuous, or do not multiply. Variations in the state of the atmosphere, independently of its thermometric and hygrometric conditions, may exercise more influence in the development or hindrance of infection than science has yet discovered;—an influence which may operate either on the infecting agent or on the recipient. Ozone, whether in excess or deficiency, probably acts thus; as I believe its redundance does in encouraging the spread of influenza. The cloud of carbon suspended over coal-

burning cities affords, by its antiseptic property, some compensation for its otherwise polluting qualities. Notwithstanding the large share of consideration which electricity has obtained as a therapeutic remedy, it may be doubted whether this primitive and all-pervading force has received the attention to which it is entitled as an organising agent, and in the production or control of disease. Many persons are sensibly affected by varying electric conditions of the atmosphere; and this in an exaggerated degree in sickness or enfeebled health. I have not been able to satisfy myself of its influence—beneficial or otherwise—in the healing of wounds; but I would invite those who still have the opportunities at their command, to renew experiments of this class; and also to ascertain whether the employment of electricity may not have some effect in the early stages of diseases dependent on the presence of germs, or even in checking the development of malignant growths. More light may be thrown on the management of infection by the further study of those agents which arrest fermentation, such as terebene and borax, or otherwise neutralise its effects: for, it should be remembered that there is a close relation between fermentation and putrefaction; and that in both fermentation and infection the activity of germ-life is much easier to prevent than to control when once established. Some of these agents are, apparently, germicides; but in other instances this explanation is unsatisfactory. The desideratum of course is to render the poison inert without injury to the patient. It is said that the infecting organisms disappear under the administration of appropriate medicines, as when quinine is given in ague. If such be the case, and as the neutralising influence of antiseptics over different organisms appears to vary, we may not unreasonably look in this direction, for an extension of our acquaintance with specifics.

The discussion of immunity after infection naturally suggests the consideration of another class of maladies, such as catarrh, gout, eczema, &c., which manifest a proneness to recurrence. In many instances this tendency is inherited; in some it seems due to the enfeebled power of resistance to an exciting cause, induced by a former attack: special sympathy with other disordered organs will occasionally explain

this persistent and intractable phenomenon; and in other cases we must thankfully accept Dr. Creighton's interpretation, in his classical work on 'Unconscious Memory in Disease.' Whether literally or figuratively construed, no other form of words would so appropriately express some physiological as well as pathological facts; such, for example, as the surviving impression in the pregnant female of a previous impregnation, as manifested in her offspring; or the recrudescence of the intermittent type in sickness, long after the ague and its exciting cause have been banished. For an analogous fact I am indebted to Sir John Kirk, who tells me that it is very common for the residents of Zanzibar, who leave the shore in health, to have a sharp attack of remittent fever shortly after putting to sea; thus changing a hot malarious air for a purer and cooler atmosphere. Probably the change of temperature may fan this dormant something in the system into active life, and thus reproduce the fever from which they had suffered at some previous time. This prolonged latency seems peculiarly associated with malaria, for which quinine is the specific remedy, acting either as an alterative in breaking the habit, or, as some suppose, by restraining the activity of a still present poison in the blood. Whatever the explanatory theory adopted, experience teaches us that general deterioration of health commonly betrays some existing weakness in the constitution, which leaves the sufferer a prey to his particular scourge, without any directly exciting cause; and this infirmity may be either inherited or acquired.

Pathogenic micro-organisms have been carefully studied by many able pathologists, but their history is still very incomplete, and the conflicting results of observation show that there yet remains much to be learned respecting them. Attempts to classify them seem to be foiled by the transformation of some, and by the probable conversion of simple and innocuous forms into poisonous fungi. Their habitat or that of their spores or germs is the atmosphere, water or the earth, as well as living or dead organic matter. In organic structure they do not differ: the same form is found in many different diseases; and some organisms, resembling each other, have varied physiological actions; in this respect

resembling the cells of early embryonic life. Some thrive under conditions which are fatal to others. The healthy living tissue seems to be competent to disqualify, and probably kill, some pathogenic organisms, which grow and multiply where the health is impaired, or in a decomposing nidus. These circumstances seem to lend support to the surmise already hazarded, that micro-organisms may acquire their virulent attributes, and are simply carriers of infection,—a privilege which probably does not appertain to them exclusively ; that their poisonous property is due to a combination of favouring conditions, by which their morphological as well as their infecting characteristics are varied : that they undergo a process of evolution in both respects ; but having acquired their special properties, they retain them, and are competent to impart them, and to generate other organisms possessing the same attributes, unless new conditions arise by the instrumentality of which they are again rendered innocuous.

Why is it that certain germ and other animal poisons act by direct absorption into the circulation, but are harmless when swallowed ; whereas others, as in cholera and diseases of which milk has been shown to be the vehicle, the poison seems to act through the medium of the alimentary canal ? It is probable, however, that this contrast is rather apparent than real ; and that the poison mixes with the blood in either case before it becomes operative, though the excreta may be charged with the poisonous organisms. That certain animal poisons should be neutralised in the secretions of the stomach is intelligible ; but it is not so plain why others should escape. Possibly those germs which are generated on a mucous surface survive in their natural habitat, where others which are strangers would perish. Most vegetable poisons seem to act indifferently, either by direct or indirect admission into the circulation.

The analogy of parasitic life in animals and vegetables is not without interest and instruction. Various plants are infested by the different kinds, though they very much resemble each other. These parasites are probably influenced, in their effects or activity, by extraneous causes, such as variations in temperature, moisture, character of soil, and

other surroundings, especially by overcrowding; as well as by intrinsic conditions, providing means of resistance or the reverse to the invasion of disease; deteriorated vitality rendering a plant more liable to the attack of parasites. Yeast manifests different forms of organism, under varying cultivation in different media; and such also, I am told, is the case with white mould. Mr. Bennett informs me that some species of parasitic fungus have "a remarkable heteromorphy, accompanied by alternations of generations. For example, the mildew of wheat (*Puccinia graminis*) and the rust of the barberry (*Accidium berberidis*) are different stages in the development of the same species: neither reproduces itself, and each reproduces the other. There are many other instances of this heteromorphy, mostly belonging to the family of *Uredineæ*." Over-feeding as well as deficient nutriment makes plants sickly, and more subject to the incursion of parasites. The higher forms of vegetable life, especially when subjected to cultivation, are similarly susceptible. Plants are influenced by heredity, after being changed by cultivation, and have a tendency, when neglected, to return, like Darwin's pigeons, to their original type: and diseases, due to malformation or deficient vitality, may be transmitted to the next generation. There is no satisfactory proof that germs are introduced into the circulation of plants by absorption through the ordinary channels, though it is not improbable such might be the case if the germs could maintain their vitality in the soil. These parasitic diseases appear to extend by contiguity; but there are not any ascertained facts suggestive of an intercommunication of their germs between plants and animals; unless, indeed, the intermittent and remittent types of fever, due to malaria, should be shown to depend on such transfer.

Parasitic organisms infest especially the haunts of man. In mid-ocean or on the summits of lofty mountains they can find no home: but where human life abounds germs increase, *pari passu*, with the population and the usual concomitants of aggregation, viz., impaired vital resistance, and the presence of conditions which favour the generation of micro-organisms. It is needless to enlarge on this subject, which is familiar, beyond referring to some of the more prevalent agencies by which, directly or indirectly, the evolution and

extension of disease is favoured in thickly populated countries. The most direct cause, besides the presence of disease, is the impurity of the air and water: but the indirect agents are still more potent, by rendering the recipients of the poison more susceptible. The craving for stimulants, over-feeding and under-feeding, sedentary life; the strain of competition for a living; working against time, and mental emotion; these and other special causes co-operate to the prejudice of those who are subjected to them. They serve to modify organisation and to disturb the physiological equilibrium which constitutes health: and, it need not be added, they are intensified by inheritance. The observed fact that infectious diseases are peculiarly fatal when introduced amongst an aboriginal population does not invalidate these remarks. In vegetation seeds thrive in a virgin soil; and fermentation is expedited where the necessary elements for its activity are abundantly present.

It is important, in exemplifying the subject of Evolution in relation to Pathology, to have a clear view of the distinction between a disease and the symptoms by which it is characterised. It is true this is an elementary lesson; yet we are so much in the habit of treating the symptoms that we are apt to regard them as the disease, and thereby much confusion is engendered; and points of contrast are thus rendered more prominent, in many instances, than is justified by their actual divergence from a common type of morbid action. Another point of equal importance to be borne in mind is, that the pathological changes which constitute the symptoms or signs of a disease are, for the most part, eliminative in their nature, and, as such, essentially curative in their purpose, though not infrequently injurious or destructive in their misdirection or excess. This general proposition is, doubtless, modified by various circumstances which influence the operation of evolution: yet the principle survives, and its prevalence cannot fail to be recognised and appreciated by all who look below the surface.

The first manifestation of the presence of any active disease, whatever the exciting cause, is almost invariably the functional disturbance of some one or more of the organs,—chiefly

those of assimilation, secretion and elimination ;—the nerve-centres, and through them the vascular system, taking cognisance of such disturbance, and reacting in the production of various phenomena, tending or designed to restore the lost equilibrium. Accidental lesions arouse a similar attention directed to the same result. The progress and issue of these contending forces—the disease and nature's remedial effort—are governed by various circumstances, inherent and extraneous ; and any special outcome dependent thereon may be perpetuated by inheritance or exaggerated by being translated into a congenial soil, whereby specialised or specific forms of disease are gradually developed.

Assuming the validity of the germ theory, so far as it is applicable to disease—for heredity is scarcely admissible in this category¹—it may be regarded as an open question, for the reasons already advanced, whether the parasitic organisms are not innocuous in their primitive state, and derive their virulence from residence in the nidus of disease or in the fluids of a diseased body (*e. g.*, the filaria in elephantiasis, of which the mosquito is credited as being the purveyor) ; a property which they retain and are competent to propagate, but of which they may be deprived by gradual culture, and be thus restored to their pristine harmlessness. Innocuous germs, scarcely distinguishable from those possessing virulent properties, may be seen in the blood, as well as in water and other ingesta. The virulence, therefore, of parasitic organisms cannot be regarded necessarily as an original property ; and it may be acquired by their transmission through successive soils, favourable to its cultivation and development in some special direction, with an environment calculated to promote the same end. And there is nothing improbable in the supposition that this order may be reversed ; that *naturally*, when all the circumstances are propitious, the virulent property of these organisms may diminish in their translation,

¹ It is said that tubercle bacilli have been found in the testis and prostate of the phthisical. But their presence there, as in other organs of tuberculous subjects, is not surprising, and cannot be accepted as a plausible reason for assuming that their germs are transferred to the impregnated ovum. Even if so transferred, do they remain inert and unprolific during the long minority of their host, and then spring into active life ? The hereditary communication of specific infection by pathogenic organisms is an improbable conjecture.

until they again become innocuous, as demonstrated artificially by Pasteur ; thus exemplifying the principle of reversion to original type. In other words, as already remarked, the susceptibility or otherwise of the recipient of infection materially helps to decide the tendency in either direction ; and there is no doubt that the soil varies greatly in this respect, and that the virulence of the poison may be attenuated or aggravated thereby. Both the animal and vegetable kingdoms supply us with analogous instances of evolution under cultivation, and of subsequent reversion under neglect. What effect artificial culture has on the properties of poisonous plants I have been unable to learn.

The analogy between biological and pathological evolution is manifested at an early period. The protoplasmic germ possesses attributes, in virtue of which it grows by absorption, multiplies by gemmation or fission, and evinces the varied potentialities derived from its parentage and its environment, which qualify it to become itself an organ with special functions. Such, too, appears to be the history of the pathological germ, whatever that may be. Many inflammatory affections which are simple acquire, under favouring conditions, a specialised character, which may be transmitted, as virus, to a healthy system ; and may display the same property as protoplasmic germs, of multiplication in the living tissues, without the agency of any specific contagium from without ; but due to a combination of circumstances which are dependent on inherent, acquired, or inherited proneness to some particular form of inflammation or type of disease.

Inflammation.—It will be interesting and instructive to examine further how far the phenomena of inflammation exemplify the foregoing remarks. It is difficult to define concisely, and at the same time satisfactorily, what is meant by inflammation ; for many considerations are involved, and the conditions change at each quickly succeeding stage. Primarily it is augmented local arterial action, accompanied by capillary hyperæmia, dependent apparently on some change in the vital relations between the blood and its containing vessels. This state is usually induced by a topical lesion, or may be consequent on some less direct provocation : but whatever the exciting cause, the local phenomena

are, probably in all instances, essentially due to reflex action, originating in the seat of disturbance, and reflected from the vaso-motor nerve-centres ; to the degree of activity of which, therefore, all the resulting local changes are attributable. The extension of this disturbance, by sympathy, to the system generally is a secondary condition, and constitutes symptomatic fever. This abnormal state of the blood-vessels must, moreover, be viewed generally, but in some instances only remotely traceable, as beneficent in intention, though sometimes, as already remarked, mischievous in its direction or in its immoderate activity. It may be thought fanciful to adduce inflammation as an epitomised illustration of pathological evolution : yet such it is. The different stages an inflamed area passes through are so many steps which are influenced by various collateral circumstances, until they reach their climax. The reconstruction of disintegrated texture is another exemplification : and where the morbid action stops short of necrosis we may, in like manner, note the retrogressive steps by which a restoration of the normal equilibrium is established : and herein we have an elementary lesson of reversion to original type or pre-existing physiological health. In like manner chemistry reasserts its sway over dead organic matter ; and by retrograde steps, from fermentation to decomposition and disintegration, the product of vital evolution is resolved into its primitive elements ; which are then prepared to share in building up a new organisation, under the constructive and energising direction of some fresh vital germ. Thus, whether the progressive evolution of these pathological changes in inflammation result in a wreck, more or less complete, of the affected area, or the pre-existing normal condition, by retrogressive steps, be re-established, each process may be watched, *e. g.*, in surface inflammation by the eye, or in pneumonia by the ear. This careful observation of nature's proceedings in both directions has established more accurate views of disease, as well as its more rational treatment, by discountenancing meddlesome interference at variance with nature's indications.

Plants manifest changes in the repair of lesion, in many respects analogous to reparative inflammation in animals. If a metallic point be thrust into living wood, Mr. Shattock in-

forms me that the local injury produces proliferation by subdivision of cells around the foreign body. The accurate detachment of the frost-bitten portion of a leaf is suggestive of the similar process in partial gangrene, entailing spontaneous separation of a necrosed part: indeed, the fall of the leaf in autumn is no less a vital act; for the withered foliage still clings to the dead limb long after the living branches are denuded.

The differing tendency of inflammation in various tissues illustrates the agency of a natural and salutary influence, by which its development is modified: and many innate peculiarities of temperament, and still more so of habits, decide the direction and issue of an inflammatory attack. Again, an inherited proclivity, some defect in the assimilation of the ingesta, or some faulty organic chemistry determines the localisation of the attack, and imparts to it a special character. In this way some morbid growths may be accounted for, as "in many cases tumours and simple inflammatory overgrowths are structurally identical."

Morbid Growths.—Tumours possess one common affinity, in the circumstance that their tissue development is due to local depraved cell-growth; and although there are many well-defined characteristics which distinguish them, there is nothing to forbid the supposition that these are consequent on a gradually widening divergence, under favouring conditions, from the typical origin to which, according to Virchow, they may all be traced, in the normal tissues of the organism, in some stage of its development. Moreover, the characteristic of malignancy is one of degree; for a sharp line of separation between the innocent and malignant cannot be drawn, as "but few if any proliferating growths are wholly free from liability to assume malignant properties." Tumours, in the proper sense of the term, *i. e.* morbid proliferating growths or neoplasms, are spoken of, by one of our most trustworthy pathologists, as having "a very close affinity with simple hypertrophy or hyperplasia on the one hand, and with mere inflammatory growth on the other."¹ Both malignant growths and tubercle may be cited as pathological con-

¹ Dr. Bristowe ('Theory and Practice of Medicine'), to whom I am indebted for this and the preceding quotations.

ditions which are communicable, by translation, to other parts of the system, and, possibly, to other individuals: yet it can scarcely be denied that they may exist without inheritance or other assignable explanation of their presence; certainly they have the properties of development and extension; but at present we know nothing respecting their apparently spontaneous beginning, except that special conditions of environment favour the production and subsequent evolution of tubercle; and that local irritation may, in some instances, determine the position of cancer. It is said that both these diseases may be inherited. This may be; but that cancer is usually so is doubtful: and I am disposed to think that sufficient weight is not assigned to the constant association between parent and child, apart from heredity, as the means by which both cancer and tubercle may be communicated from one to the other. But beyond these sources of contamination their *quasi* sporadic origin and elective localisation are problems, the solution of which must be sought in the endeavour to unravel the complex elements, past and present, which, in the aggregate, and in their fortuitous and favourable combination, constitute the latent morbid condition that awaits an appropriate stimulus to be converted into active disease. In normal evolution a similar association of what we should term accidental circumstances favours the production of new and unexpected forms, which may be perpetuated by inheritance, or be modified and varied by manifesting fresh attributes and new affinities.

Fevers.—However speculation regarding the origin of the so-called fevers may differ, there is a general consensus of opinion that each is due to a specific poison, which produces recognised and well-defined indications of its presence in the system. It may be added that their associated effects, *i. e.* the signs and symptoms, are an expression of the effort made by nature to eliminate the poison; and that the attendant pyrexia denotes the participation, by sympathy, of the various organs in the disturbance, and especially that of the vascular and nervous systems. Whatever the poison may be, the contagia have the property of multiplication in the affected body, and of infecting, by transmigrating, the bodies with which they are brought into contact. Possibly the period

of incubation may simply represent the interval required for that self-multiplication to attain the expansion necessary for the outward manifestation of the disease, the intensity of which might, therefore, be dependent on the protraction of that period ; but this would necessarily be partly governed by the quantity of poison imbibed, and by other circumstances already noticed.

Notwithstanding the marked contrasts in many of the features of these fevers, there are certain points of resemblance, indicating broadly some affinity between them. The general disturbance which the presence of the poison occasions is similar in all, varying in degree according to circumstances, in which the dose, the length of incubation, and the favourable nature of the soil for cultivation are jointly potential. The principal organs by which elimination is attempted are the skin and mucous membranes, which are likewise the chief communicants and recipients of the contagia. There are also more special affinities, as between the different forms of pock, between measles and roseola, possibly between scarlatina and diphtheria, and between the latter disease and membranous croup. Opinions appear to be divided as to the presence of a specific contagium in *Typhus* and *Typhoid*. The former seems to be more influenced by, if not absolutely dependent on, surrounding conditions associated with a crowded population, such as defective ventilation, food, and cleanliness. The condition of the recipient is, therefore, another important element in the development of this disease. Whether the contagia, if poisoned germs, are simply latent and awaiting the opportunity which a favourable soil and surroundings would afford, or whether innocuous germs receive their poison from these surroundings, seems to be of little importance : probably both theories are correct in this as in some other instances. In typhoid a high temperature appears to be specially favourable to the development of the poison ; and the intestinal discharge from which it is derived seems to "contain some specific, but at the time innocuous, organised substance," which afterwards, under decomposition, becomes virulent. This is an interesting fact, as illustrating the generation of a virulent germ, or, more probably, the conversion of an innocent organism

into one of a specific type, in decomposing animal matter ; resembling in this respect non-specific poison generated in the same way ;—an important step in tracing these specific poisons to their source.

Cholera may be classed with typhoid in respect of its origin, favouring surroundings, and epidemic character ; and they also resemble each other, apparently, in being developed from germs which multiply indefinitely, and ripen into virulence after their discharge from the intestine : but in other respects the two diseases present a striking contrast. *Cholera* is said to be indigenous in India, and to assume periodically an epidemic character. I am not aware whether it has been satisfactorily shown that this disease does not originate spontaneously. Unquestionably both environment and personal qualification exercise much influence in its development. Not only habits of life but special conditions of health may predispose to an attack, as demonstrated by the importance of careful diet and precautions in case of diarrhoea, during the prevalence of an epidemic. Moreover, isolated cases occur periodically, which differ very little from the true Asiatic type. It seems reasonable, therefore, to suppose that the evolution of cholera, in its virulent and epidemic form, needs certain conditions, under which its contagia or germs become highly poisonous and prolific, but again lose this character as these conditions are gradually withdrawn or artificially controlled. Assuming, then, that the contagia in typhoid and cholera are, as is most probable, parasitic organisms, the circumstance mentioned, respecting their primitive innocuous character and subsequent virulence, seems to point to the important conclusion that their poisonous nature is an acquired and not a necessary attribute ; that they obtain their infecting property from the nidus in which they are bred ; and that they may be deprived of this property, as has been demonstrated artificially, by the withdrawal of the conditions which favour the development of their virulence. It may be added that the symptoms of non-specific septicæmia, according to Burdon Sanderson, very closely resemble those of cholera in their leading characteristics.

The recent and startling announcement that scarlet fever may probably be communicated from the cow is fraught with

much interest, not only for its own sake, but on account of the speculations it suggests in reference to the development of other diseases under similar conditions, notably diphtheria and vaccinia. It may be reasonably argued that if milk be a suitable medium wherein the germs of scarlet fever may mature, and may produce this formidable disease when swallowed, why may not vaccinia, in like manner, be regarded as competent to produce variola, after admixture with the milk and cultivation therein? In both cases the udder of the cow is the source of the contagium: and whilst transference, by inoculation, to the human subject may modify its action and change the character of the disease, cultivation in a suitable medium may intensify it. As regards the cow, in neither case does the disease seem to be attended by constitutional disturbance. The two cases *seem* to be parallel.

Erysipelas.—The difference of opinion among pathologists respecting the specific nature of erysipelas is best reconciled by regarding it as a simple inflammatory affection of the skin and subcutaneous areolar tissue, which may assume a specific type, under the influence of local environment and temporary or persistent personal susceptibility. I would even include, in the same category, erythema, where the areolar tissue is excluded from participation; and likewise the more exaggerated class of cases in which deeper textures are involved, and diffused suppuration ensues. Such, at least, is the teaching of one's hospital experience. The constitutional disturbance varies in accordance with the extent and depth of the inflammation; and I should as anxiously remove an operation from the proximity of a case of phlegmonous inflammation as from one of idiopathic erysipelas. Is not the latter form sometimes climacteric and eliminative, as some other forms of inflammation and carbuncle occasionally appear to be? Pneumonia may be included in this category, occurring sometimes without any other assignable cause, and, if cured, leaving no ill effects behind.

Rheumatism and Gout.—However opinions may differ respecting the affinity between these two diseases, there certainly is, in their history, development and characteristics, much that is common to both. Soil and atmospheric influence are extraneous predisposing causes, which seem competent to

induce rheumatism without any special predisposition on the part of the patient; so that some localities are almost as notorious for this complaint as others are for ague. Yet there is no doubt that intrinsic susceptibility, which is generally acquired or fostered by incautious excesses in diet, co-operates in promoting the development of the disease. The alliance between rheumatism and gout has found expression in the conjunction of the two words: and although rheumatic gout may not be a strictly pathological compound, it indicates the fact that there is, practically, no defined line of separation between the two diseases. The special characteristics of gout do not appear to be dependent on environment: some predisposition to its development no doubt exists in most cases; and in some this inherited proclivity, handed down perhaps through two or three generations, assumes an intensity which is almost uncontrollable. But it may be acquired, *de novo*, by introduction into the system of the elements on which it thrives, provided there coexist that faulty organic chemistry which liberates those elements to work their will. To deny, so far as practicable, these necessary conditions, and to put the vital laboratory in working order, seem to be the rational indications for treatment: but it may require the self-denial of two or three generations to obliterate this morbid inheritance, and to secure a reversion to the original type of health. The elective and eliminative characteristics of gout, and its apparent affinity with the neuroses, are interesting features in its history.

Influenza.—Whatever may be the contagium of influenza there can be no doubt that its epidemic character is due to some unknown cause, and that it is communicable from one to another. But it would be a bold assertion to say that there is any strict line of demarcation between this epidemic form of catarrh and common catarrh. In all their essential characteristics they are identical, and glide one into the other. Some persons are specially susceptible of both; and atmospheric influences often render common catarrh in a measure epidemic; its communicability, moreover, is as recognised as that of influenza. Certainly the striking epidemic character of the latter, and the severity of the attack, involving, as it often does, the mucous membrane of the

sinuses in, and in communication with, the nostrils, would seem to point to some special atmospheric cause,—not improbably, as conjectured, an excess of ozone. In some instances the suddenness of the attack is suggestive of immersion in a poisonous current of air. Hay fever exemplifies the influence of special susceptibility, whatever may be the exciting cause of this allied affection. Probably catarrh is sometimes eliminative.

The study of disease on the lines indicated is not only consistent with the theory of biological evolution, but is also supported by pathological observation. In both cases the chief factor, heredity, is modified by environment and intrinsic circumstances ; and in both a tendency is manifested to assume more complex characteristics, or, under favouring circumstances, to obey the principle of reversion to original type. Further, divergence from a simple type does not imply the absence of early affinity, or even of identity of origin : and these remarks apply to the vegetable as well as to the animal kingdom. As in biology complex forms are the offspring, through many intervening grades, of one common parentage of simple type ; so, in pathology, under analogous circumstances favourable to such evolution, or it may be degeneration, a simple deviation from a normal state of health may issue ultimately in the development of specific disease ; and the variety of phases or combinations through which each has passed renders it difficult to trace its derivation and lineage in either case.

Thus it is likewise with man's moral nature, and the psychologist may find satisfaction in tracing, on parallel lines to the foregoing, the evolution of moral deformity and disease, in such wise as would leave but little to the imagination to render the analogy complete. The disposition to special forms of degeneration or active disease is, unhappily, prevalent in mind as well as body ; and heredity asserts in each its sway, by repeating original abnormality and acquired vice. Contagia in various forms infect the moral atmosphere, and multiply abundantly with civilisation and in a crowded population. Some are subtle and slow in their operation ; others, in a receptive nature, where the will to resist is

feeble, defy control and are rapidly destructive. The dis-tempered cell-growth in the moral man manifests the same affinity with its healthy type, as the morbid growth of the material man holds to the normal tissues of his organism in some stages of its development : in each case the association constitutes the connecting link between health and disease. Some virtuous impulses, if uncontrolled or misdirected, are prone to expand into vicious habits : and envy, hatred, and malice may have small beginnings ; but, if nurtured in the rank and congenial soil of selfishness, they ripen into a moral cancer, which poisons the life that nourishes it. The inlets of evil are many, and thoughtless and foolhardy exposure to contamination is fraught with equal risk in both cases. The craving for mental and emotional stimulants may be classed, in its effects, with the importunity of the sensual appetites, the morbid indulgence in each case entailing an enfeebled power of resistance and a dissipated habit, which need only time and opportunity, with freedom from restraint, to issue in hopeless degeneracy or disease. On education and training, as on medicine and hygiene, we rely for the means by which to correct these morbid tendencies in either case, and to fortify the moral as well as the physical nature against the many insidious inroads of disease : but when that has established its hold, the enforced sacrifice of the offending member, alike literally and figuratively, is often the only remedy whereby life can be saved. "*Nemo repente turpissimus*" is an implied recognition of the law of evolution in our moral nature, in the same sense as it is suggested that our diseases are the culminating product of evolutionary steps. The aim, alike of the moralist and of the physician, is to fortify the constitution, and to neutralise the activity of the poison germs, by withholding the conditions essential for their development and multiplication ; and thus to arrest and reverse the downward tendency, and to restore to man a larger share of his pristine vigour and purity.

Many things in biological evolution are obscure, and many facts are, with our present knowledge, too stubborn to conform to its law, or to be brought within the range of its assumed principles. Yet, that law is not rejected, those principles are not ignored. So likewise the details, by which

the law of evolution as governing pathological action may be exemplified, will require time and patience to develop; together with a recognition of, and some faith in, the principle of "reversion to original type" in the study and treatment of disease.

P.S.—Since this paper was written I have had the opportunity, through the courtesy of Dr. Creighton, of perusing his valuable monograph read before the British Medical Association in 1883, on the "Autonomous Life of Specific Infections;" and am gratified to find that my views are so much in unison with his. Dr. Creighton's observations on the history of yellow and jail fevers, and on the remarkable immunity of the black race from the worst effects of the former, have an especial interest in relation to the subject of this paper. I am tempted to repeat a quotation from Sir Thomas Watson, which this address contains, as it anticipates so precisely some of the views I have ventured to express. When speaking of the contagiousness of Egyptian ophthalmia Sir Thomas observes:—"There is nothing absurd nor unlikely in the supposition that diseases may arise from some other source, and then become capable of spreading by contagion. . . . My own creed on this matter is this: that the disease may and often does arise independently of contagion, from the agency of ordinary causes of inflammation; and that, having so originated, it acquires contagious properties, which develop themselves only under circumstances that favour the propagation of most of the contagious complaints." A similar opinion is expressed on the same subject by Mr. Travers in the treatise already quoted. In speaking of this suppurative form of ophthalmia, so fatal to our soldiers in Egypt, he remarks that he entertained no doubt that the disease originated in gonorrhœa "exasperated by local causes, and especially by its facile and extensive communication through so large an assemblage of men, under the favouring circumstances of predisposition and excitement."

THE

PHYSICAL CONSEQUENCES, PERSONAL AND SOCIAL, OF IMPURITY.

(An Inaugural Address, read before the Church of England Purity Society, Nov. 5, 1885, and printed for the Society.)

ARGUMENT.—*Introduction.—Early training.—Impurity in boyhood and its consequences.—The necessity for the practice of impurity discussed.—Impurity in manhood, and its consequences, personal, social and national.—Extraneous incentives to impurity.—Remedies.—Legislation on the subject.—Institutions.—Appeal to the worldly man, and to the nominal Christian.—Conclusion.*

I HAVE been asked to address you on the subject of Purity in its personal and social aspects ; and my profession naturally indicates the direction which my remarks should take. It is a distasteful theme one would naturally shun ; but its importance, both socially and personally, cannot be exaggerated ; and we have the highest authority, that of God's Word, for treating it in plain and unmistakeable language. I shall endeavour to follow this example, avoiding that which is revolting in detail, so far as is consistent with a clear understanding of what I wish to say.

We are often prone to disconnect the personal and social relations of this and allied attributes ; such as honesty, truthfulness, temperance, and the like ; and to regard our own conduct too selfishly, without estimating its influence on

those around us. But it is superfluous to remind you that as society, in the aggregate, consists of units, each component element must influence the mass ; and it is difficult—indeed impossible—to estimate how much our own personal conduct may guide or mislead, may fortify or weaken, those with whom we are thrown into contact in our daily intercourse. But the vice of which I have treat has also a wide-spreading power, by physical contamination, which is less hidden in its effects, though known in the fulness of that power only to the Medical Profession.

In directing your attention specially to this phase of impurity, I wish to make two remarks before proceeding. First, we must not confuse the sexual passion, which is a natural endowment, with its unlawful encouragement or gratification, which alone is sinful. Secondly, I would warn you and guard myself against any perverted interpretation of the present treatment of the subject. By narrating something of what my professional experience has taught me, I shall appeal to the lower motive of personal security, and the *expediency* of leading a pure life. But this is not the incentive which the Christian would suggest or with which he would be satisfied. Purity of *conduct* from dread of consequences, or such purity as passes current in the world, is a standard which differs widely from the purity of *heart*, which has the promise of the Saviour's choicest blessing. Yet the latter is the standard which must be aimed at if the life and conversation are to be consistently in accord with its requirements ; and the education of the heart, in this as in other respects, cannot be begun too soon. Purity is a tender plant, and needs early and careful nurture, lest noxious weeds spring up and choke its growth by usurping its place. A mother who is alive to her duty would watchfully guard her child from contact with anything that can sully the bloom of delicacy.

It may be thought foreign to my purpose to refer to this early training ; but strict supervision even in the nursery is not an ideal necessity. A impure nurse will contaminate boys under her charge, by precociously awakening sexual feelings at an age that would scarcely be supposed possible. Yet so it is ; and in this way the seed may be sown, which is only

too likely to spring up and bear fruit before the period of manhood is attained.

The next stage of life is now reached, and the boy is sent to school, where he mixes with others and occupies the same sleeping-room with his companions. It is here, especially in the more advanced and larger schools where there is less personal supervision, that many a boy has been ruined by bad example. Of course I refer to the sadly prevalent practice of solitary vice. And now the physical effects to which I have referred begin to manifest themselves in the confirmed victims of this vicious habit. Its direct consequence is nervous exhaustion, evinced in various ways. Languor, distaste for active exertion bodily or mental, general want of energy or interest in work or play, accompanied by an averted look and preference of solitude; and developing, perchance, in manhood into loss of self-control and insanity.¹ Yet this impurity is as often due to ignorance as bad example. Indeed, ignorance has the larger share in the development of the propensity; for, if forewarned, a well-disposed boy may escape contamination, and be likewise armed against the solicitations of a passion, the meaning of which he scarcely understands, and the consequence of yielding to which he cannot otherwise appreciate. I do not hesitate, therefore, to counsel every father, and every responsible head of a school, to explain to their boys, individually, the nature of the temptation to which they will be exposed, and its penalties, both moral and physical. I know this advice will be met again, as it often has been in the past, by the contention that the youthful mind is thus polluted by the very effort that is made to secure it from contamination. This is, I am satisfied, a fatal error; it is not in accordance with the plain teaching of Scripture, and it certainly is at variance with my own observation and experience. Reticence on this subject is a cruel denial of the just claim of a child on his parent; for it is idle to suppose that he will not be subjected to

¹ The association of this vice with epilepsy is also an admitted fact; but their respective relations as cause and effect are not established to the satisfaction of those (whom I have consulted) who have had the largest opportunities of investigating these cases in lunatic asylums. The type of insanity may be either that of melancholia, or it may assume a more violent or dangerous form.

temptation by his own nascent passions ; or that he can escape pollution in the midst of many, where one so disposed can and generally will corrupt others. And I give this advice the more earnestly from a conviction of the extensive prevalence of this habit.¹ We must not despise the day of small things, or forget that the boy is father of the man ; and that the precocious indulgence of boyhood may, for obvious reasons, ripen into the ungovernable passion of manhood, and thus become responsible for the support of prostitution. The medical adviser's duty in these cases is painful but clear, notwithstanding the often indignant repudiation by the parent of his son's guilt. And many a tale of self-abasement and remorse has he to listen to, from those who seek his counsel and assistance later on, whose early indulgence in this vice has rendered life miserable, and even incapacitated them for domestic happiness.

I am now speaking of our own sex, and I do not venture to extend this admonition to mothers. Yet, even they may exercise a wise discretion in warning their daughters, under similar circumstances, to shun, as they would a deadly poison, indelicacy of conversation or in person, in mingling with their schoolfellows. The bloom is soon brushed from the ripening fruit ; and even *their* schools are not exempt from the danger of infection. As of old, the tree is pleasant to the eyes, and is represented as desirable to make wise ; and if the Tempter be listened to, can the daughters of Eve expect to escape where she fell ?

We now come to another period of life, when the youth leaves school, and is launched on the world ; and, if without high principle and efficient moral training, he is like a rudderless ship, at the mercy of the winds and waves of impulse and passion. But it is my business to speak to you specially of the *physical* risks and penalties, both personal and social, of an impure life ; and if it be in my power to communicate to you only a faint impression of my own convictions, derived from no limited experience, my observations may serve, so far as such incentive is admissible, to fortify your resolution to lead a life of continence and purity.

¹ Calculated by some writers as high as 80 or 90 per cent.

Here, however, I must first say a few words respecting a preliminary hindrance to chastity which has been suggested by some persons, who allege that sexual intercourse for man is essential to the preservation of health. This assertion I emphatically deny; but it may be profitable to consider this apology for vice a little more in detail. Setting aside the plain fact that such a natural law would be antagonistic to God's Word, I would appeal to Physiology and experience in confuting this opinion. Certainly it behoves those who maintain it to prove their positive assertion by observation and statistics, if not by scientific argument; yet I can discover no better support than the feeble prop of individual experience; which, without challenging its unbiassed character, is worthless for scientific purposes. But such experience as I have derived from general observation is altogether opposed to this opinion. May I not appeal to any one of my audience whether he has ever met with an instance which supports this view? Sickness and death are constantly suspending or extinguishing the legitimate claims of married life, yet without entailing consequent loss of health. The passion may be strong and the craving imperious, but this proves rather the slavery of the individual, than the necessity of a body which is kept in subjection. Again, is this requirement for the purpose assigned exemplified in our domestic animals? Assuredly not. Is it so with our hounds which are trained to be fleet and strong as well as docile? This intercourse is prohibited during the hunting season. Is it so with our horses? On the contrary, in the finest specimen of their kind, the racehorse, entire sexual abstinence is a condition of his enjoying all his powers, and therefore his health, in perfection; and it is only when his prime is past that he becomes the stud-horse. Nay, further, tell me, you who adopt athletic exercise as your manly recreation, is sensual indulgence permissible when you are training for some feat requiring strength, agility, and endurance? Do you not follow the example of the Greek athletes and wrestlers of old, whose ascetic principles enjoined abstinence from all sensual and effeminate indulgence? It cannot be denied that it is then forbidden by common sense and experience of its enervating effect. And we know, moreover, as regards

animals in a state of nature, that, though in many instances the male may be at all times ready, he is repulsed by the female, except during the breeding season and for impregnation.

I think it not improbable that the opinion I am now confuting has been in a measure sustained by erroneous physiological views, founded, artfully or ignorantly, on the assumed parallel action of organs, the function of which is to produce various secretions for specific purposes. Such are the salivary glands, the liver, kidneys, lungs, and many others, including those which are concerned in reproduction. Now some of these are in regular though not necessarily continuous work ; and a prolonged suspension of their function involves derangement of health or more serious consequences. Thus, we cannot digest our food properly without the saliva, and not at all without the gastric juice ; a sluggish liver produces jaundice ; and arrested action of the kidneys or lungs entails more or less speedy death, by the retention of an active poison in the blood. All this is intelligible. But there are other organs which have an intermitting or periodical activity, which is determined by circumstances, and of which we have an especial exemplification in those which are engaged in reproduction. Thus, the breast yields milk when it is needed, and its function is suspended when that requirement ceases. It is a fallacious inference, both illogical and at variance with physiological teaching, that, because we are endowed with a bodily appetite which is an essential condition of our very existence, in the fulfilment of the command to be "fruitful and multiply," therefore the indulgence of this appetite is essential to bodily health.

It is almost needless to follow this question into its social bearings. If the gratification of lust is a legitimate necessity to men, who are to be the associates in ministering to this demand ? Could society be maintained on such conditions ? If you claim this privilege for yourself can you deny it to your neighbour, or complain if its assertion touch and pollute your own home ? The canker has eaten deeply into society as it is ; but God forbid that this delusive theory should find favour, save with the ignorant and reckless, or with those whose boasted consistency is manifested in conforming their principles to their vicious practice.

It may be asked, are there any physical penalties consequent on illicit intercourse besides the risk of infection? This is a natural question; and my reply is, there is the risk of excess, due to the prevailing characteristic tendency of human nature to be attracted by that which is prohibited, and to esteem lightly that which is lawful; a characteristic represented in Scripture under the oriental figure of "the sweetness of stolen waters," and recognised even by the licentious heathen poet;

"Quod licet ingratum est, quod non licet acrius urit,"

and the consequence of such excess is enervation and premature decay, both bodily and mental.

Of specific infection in its various phases I dare not speak particularly. The subject is too revolting save in its scientific aspect and to medical men. Typhoid and scarlet fever may kill, but they do not maim, disfigure, and lastingly taint the blood as this poison does. Many different diseases have their habitat in special organs of the body, but this invades them all. Its hideousness is often visible in the marred features, and scarred skin or maimed limbs of its victims. The bones, the senses, and the brain itself are included in its deadly grasp. Often as loathsome as the Eastern leper their self-inflicted suffering makes life a burden to the tainted; and like the leprosy of old renders them objects of pity and disgust to those around them. And these are the personal risks—perchance of life-long duration—which are incurred by those who do violence to their moral instincts to gratify their carnal impulses. "Their bones are full of sin, which shall lie down with them in the dust." (Job xx, 11.)

But is this all? Far from it. For here is unfolded to the trained observer and adviser the wider circulation of this poison. To him is imparted, perchance, the secret of domestic misery which is hidden from the world. He knows why children are born but to die, or, still worse, to survive with shattered constitutions, to be a lasting reproach to their fathers, and to become themselves the parents of an enfeebled progeny, a degenerate race; thus realising, in the transmitted consequences of sin, the terrible penalty exacted from those who defy God's written law.

This, then, is the grievous physical wrong which personal impurity is capable of inflicting on society ;—a public offence which it is the duty of society, for self-protection, to check at its source by every available legitimate means. To incur the risk of physical contamination is not only a personal sin, it is a social, nay, a national sin, in view of its possible consequences. Even medical men can but guess at the widespread influence of this curse, merely on the physical development of our people, to say nothing of the mental deterioration and moral apathy which it entails. It is pre-eminently a selfish sin, to which its votaries yield themselves, regardless alike of their wretched partners, and of its social influence. And yet this vice in men is tolerated and even countenanced by society, as venial, and consistent with the character of gentlemen. What a prostitution of the etymology of this expressive word ! Is there aught that is either gentle or manly in this self-defilement, in thus aiding in the degradation of woman ? It is a foul blot on the enlightened page of this nineteenth Christian century ; and I earnestly call on each one who hears me to take his part in striving to erase this dark stain by exhortation and example.

It was my intention to support my statements by more detailed and circumstantial proof ; but I trust I have said enough ; and I gladly turn from this most repulsive phase of my subject, to a brief consideration of some extraneous *incentives to impurity*.

It is a saddening consideration, which is forced on us in various ways by the history of advancing civilisation, that so many of the blessings which are, so to speak, gratuitously supplied to us, or are due to scientific discovery and enterprise, are abused and perverted to base and noxious purposes. I will not detain you by the easy task of exemplifying this proposition, except in its application to my present subject. The arts of printing, of engraving, of photography, and even mechanism, have been coerced into the service of this degrading vice. And need I add how often personal and mental gifts and polished manners have been satanically prostituted to the same vile purpose ; winning confiding affection by stealth and deceit, and thus carrying desolation and misery into many a peaceful home.

Our literature has much to answer for ; not only as exemplified by those low-class publications which pander openly to this base passion, but by others also which have free circulation among the so-called higher classes of society. And herein I recognise a grave deterioration since I was young. The taste for the coarse fiction of Fielding and Smollett was then dying out, and the pure tales of the " Wizard of the North " were the standard of public taste and approval. But now the passion for exciting reading grows with and stimulates its supply. By throwing a spell around the feeble mind, such sensational suggestive writing engenders a morbid sensibility which is the soil best suited for fostering the animal passions. I am far, indeed, from advocating the suppression of works of imagination : this faculty needs nourishment and cultivation, but with judgment, and not by the sustenance derived from an exaggerated ideal, which leaves its owner a prey to sentimental enervation, alike impotent to resist the pleadings of passion, and unfitted for the stern realities of life. I fear I must admit that these remarks are chiefly applicable to the gentler sex, though not altogether inappropriate to ourselves.

Again,—what is to be said of our daily newspapers ? Even the narration of what is occurring from day to day is often accompanied by details which are unnecessary except in catering to the morbid taste to which I have been alluding ; not to speak of the awful shock which has so recently thrilled through the length and breadth of our land : awful in the facts disclosed and in the undisguised and indefensible coarseness of their communication, though I doubt not well-intentioned. Yet it is sad, whatever good may have been thereby wrought, to contemplate how many young minds must have been contaminated by reading that which too often has a defiling fascination, even whilst it disgusts.

As the pen so the pencil is enlisted in ministering, by suggestive or loathsome delineations, to impurity. I cannot say I have much sympathy with those who denounce the portrayal of the nude female form in the higher walks of Art. In the impure such works may be perverted, as are many other things in themselves lawful and admissible, by their own defiled standard. But it is not so with the pure ; and

if a morbidly fastidious taste or sickly sentimentality is to be consulted, our galleries would be shorn of some of their most precious gems, in the representation of the human form, both male and female : for surely the same brand of exclusion must be affixed to each. Of the training required for the production of these works of Art it is not within the province of this address to speak ; but it is refreshing to learn, from published authority, that the nude female model is never employed in the schools of Vienna, Berlin, Dresden, and Munich, as the eminent artists who direct these Institutions believe the practice to be unnecessary.

But Art is prolific in designs *intended* to feed this craving of the profligate for aught than can stimulate their depraved appetite.

Many of you may be acquainted with the existence of a "Society for the Suppression of Vice," the proceedings of which are directed principally against the exposure for sale of indecent publications, prints, photographs, and other objects, which the Society is legally entitled to seize. Some years since I was invited by the Secretary to visit him and view his collection. I dare not attempt to describe to you all the contents of that ghastly museum of sensuality. Not only were there photographic representations from life of the most obscene kind, but similar transparencies for transmission by post without detection. I cannot speak further, in public, of other things that I saw, many, alas ! designed to excite and gratify the passions of women. Yet these were only a few samples shown to me before their periodical destruction. This Society has been in existence for more than eighty years, and during the period that a record has been kept, and with but limited funds at their command, they have, besides the conviction and punishment of numerous dealers, destroyed nearly four hundred thousand obscene prints, pictures, and photographs, and eighty thousand books and pamphlets, with five tons of letterpress in sheets, and vast numbers of obscene songs, circulars, cards, snuff-boxes, and vile articles. I will not detain you with any further details of the Society's work, which merits more support ; for its objects are most praiseworthy. But the impression left on my mind was the natural one ; that the greatest activity and utmost

exertion of its agents can succeed only partially in contending with the artifices of those who initiate and promote this traffic ; and can divert but a small stream out of the widely diffused channels emanating from this cloaca of iniquity and pollution.

It is almost superfluous to condemn other habits of dissipation as tending, directly or indirectly, to foster impurity. Indolence and luxury, both mental and physical, excess of stimulating food, and especially of drink : in short, the absence of self-denial in the conflict of contending good and evil impulses can have but the one result of giving rein to the passions which are clamorous for liberty ; and false notions of manliness are adopted and acted on, because they are pleasant and acceptable to the sensualist, who avowedly rejects self-denial as unworthy to be a guiding principle of his conduct.

I would willingly pass by, unnoticed, the share which female frailty has in acting as an incentive to impurity ; for very much is due to thoughtless vanity and misguided love of admiration, as well as to the tyranny of fashion. Yet surely this is carried to a culpable extreme in the style of dress, or rather of undress, of evening parties, and in other artificial expedients in costume and deportment, which are supposed to be more alluring, and are therefore preferred before the adornment of a meek and quiet spirit. I am neither Puritan nor Cynic : I can sympathise warmly in the legitimate pleasures of the young ; and it is not part of my creed that there shall be “ no more cakes and ale :” for our God has given us all things richly to enjoy, though we are not at liberty to abuse His gifts. But I would ask, is it possible that women can believe such things as I have been alluding to are pleasing—nay, that they are not repulsive—to men of pure minds : and is it politic—to adopt no higher standard—that they should, even inconsiderately, help to lower the standard of purity in those on whom the happiness of their future lives so much depends ?

Far more perilous are the scenes which may be witnessed in some of our theatres and other resorts of public entertainment. How can young men retain their purity of heart if they frequent such polluted haunts ? The Drama is and ought to be a lawful source of pleasure, and even of educa-

tion, if not disgraced, as is too often the case, by associations and spectacles which it is a shame to behold, and which ought to be proscribed by public opinion.

It is unnecessary that I should speak of the deficient housing of the poor as an incentive to impurity: for this crying evil has been amply discussed, and we may hope that legislation will soon do something to remedy the deplorable conditions under which the sexes are compelled to herd together. But I would remark that, so long as a better example of purity of life is neglected by their superiors in rank, it is unreasonable to expect amendment in those whose temptations are so great, and who naturally plead that low standard of morality as an excuse for their own vicious habits.

Such, then, are some of the provocatives to, and physical consequences of, impurity. The remedy is not far to find, if honestly sought by each individual man and woman. I speak advisedly in thus naming the two sexes; for women have like passions with men, though latent in the former when unsolicited, or veiled by innate modesty and restrained by the verdict of society on female incontinence, as well as by motives of expediency which it is unnecessary to recite. But why should the verdict of society thus differ in its judgment on men and women? It cannot be denied that the sin is the same in each case; yet how different is the award. I need not ask whether this is just: but, unhappily, the chief transgressors are the law-givers; and they have established a cowardly unwritten decree to shield themselves. If women would rebel against this injustice, instead of sanctioning it and condoning the vice, they would initiate a powerful agency for its suppression.

Legislation has lately been directed to the subject of prostitution; and the indignation excited by the hideous revelations to which I have referred has opportunely, though insufficiently, expanded and strengthened the shield that is thrown over young girls. But no law can protect a trusting woman from the heartless wiles of the seducer. To plan deliberately the ruin of one whose chief if not only fault is self-abandonment, and then to cast her off, is a heinous sin of the darkest dye, which exemplifies the affinity of cruelty with lust. Such brutality must surely have its retribution, save

in the most hardened, in a life-long remorse, and the embitterment at its source of every spring of healthful pleasure and domestic happiness.

There is one act of the Legislature which I would fain pass by in silence, but respecting which it may be expected I should say a few words. The divided opinion which exists regarding the Contagious Diseases Act proves the difficulty that is experienced in arriving at a satisfactory conclusion as to its justification: and knowing, as medical men alone can know, the extent of the national physical consequences of specific infection, I can scarcely wonder that the majority, as I believe, of my Profession are favourable to a continuance of this Act. Of its agency in materially limiting disease there can be no doubt; and on this fact, statistically ascertained, it rests its claim to national sanction. But, it is argued, to legislate with the effect of securing immunity to the vicious from the consequences of their transgressions, is tantamount to giving a sanction and encouragement to sin. This construction may be fairly urged so far as the *quasi* sanction is concerned; but I think it questionable whether the Act affords encouragement, except in rare instances, to those whom it immediately affects; as they are generally reckless of consequences. And I venture also to say that I do not think its special compulsory clause can be justly regarded as constituting a reasonable ground of complaint to those who are subjected to its operation. It cannot be termed an invasion of the liberty of the subject, for all have the alternative option of withdrawing from their occupation: and it must be remembered that the infected are consciously and fraudulently offering to the buyers an insidious and destructive poison, in conducting a traffic which is not, and cannot be, prohibited by law. Moreover, I am credibly informed that their obligatory seclusion for medical treatment has, in not a few instances, led to reformation.¹

¹ It is stated, on authority, "that of the patients received into the Royal Albert Hospital, 45 out of every 100 had been induced to refrain from returning to an evil life." It has been also shown that great numbers of girls and women, who had been found in improper places and in bad company, returned to their friends when they found they were under the observation of the special police; and very many others discontinued their immoral lives on being cautioned; and were consequently not registered.—'Lancet,' 1873-80.

There is yet another plea which may be reasonably advanced in support of the Act, which should find favour with sister women. It is the indirect protection which it affords to the innocent and unsuspecting girl who is to be the future wife and mother.

The question, in short, seems to resolve itself into this. Is the national benefit conferred by the Act such as to outweigh the assumed consequences of the national recognition of a vice which no legislation can suppress? Are we at liberty to violate an abstract principle because we have proved the material advantage derived from such violation? If it can be demonstrated that vice is thus *directly* encouraged there could be but one answer to the question: but I am scarcely surprised at the conclusion reached by the advocates of the Act, who reject this suggestion, and attach less importance to the infraction of a principle which they may regard as prospectively and contingently inoperative, than to what they consider to be the public duty of limiting the physical consequences, remote as well as immediate, of vicious conduct which is tolerated and condoned by society.

The selfishness of individual impurity is the root of the evil; but the laxity of public opinion on the subject has also much to answer for: and herein exists, as it seems to me, the only valid objection that can be urged against the Act, that it fosters that laxity: for, by throwing its protecting shield over the offender, it is regarded by many as lending countenance to the offence.

And here I may be permitted to introduce a short quotation; the only one with which I shall trouble you in this address. It refers to the latest Act of legislation on our subject; and it derives weight from the earnestness of the words, and from the authority of the statesman from whose lips they recently fell. "You have heard," he says, "perhaps too much in recent days of crime and sins and sorrows, which it is a shame to mention. You have heard statements of corruption, and you have heard proposals of legislation by which it was hoped that such corruption could be stemmed. There is only one remedy for such corruption, and that is the true teaching of the principles of Christianity."*

¹ Lord Salisbury. See 'Times,' Oct. 8, 1885.

In this opinion I heartily concur : and I may add my conviction that if more attention were given to religious and moral education in our schools, even at the expense of the overpressed secular instruction which competition encourages, our boys and girls would grow up into stronger and better men and women, and more worthy citizens of a Christian State.

Many excellent Institutions exist, in the form of Rescue Societies and Vigilance Committees. I should be sorry to utter a word which could be construed as in any way adverse to these Associations. It would be cruel to deny a harbour of refuge to those who are sore pressed or desirous of reformation ; but I fear the benefits conferred are not commensurate with the means employed. Far more good is accomplished, in my opinion, by anticipating the consequences to young girls who are attracted to our great city or who have employment here, but are without home or friends. Institutions which have this object in view do good by anticipating evil ; and I would gladly see them extended so as to embrace all who are homeless and unfriended.

There is an economic law, well known to commercial men, that supply, when it can be obtained, will keep pace with demand ; and this law, as I have stated when speaking on this subject on a previous occasion, is as applicable to prostitution—the dealer being the procurer—as to other articles of commerce. Of this truth we have had a remarkable illustration in the recently published details to which I have alluded. Volunteers there are for the service ; but if they are insufficient to supply the demand, the press-gang is set to work that the ranks may be filled up. It is a sad thought, to carry out the simile, that deserters, rescued from their bondage, will have their places occupied by freshly drafted substitutes ; yet such must be the case, so long as the demand is unsatisfied. Therefore it is that I rejoice in the formation of this Society, as it is based on the only principle which can effectually cope with the evil by reforming men and thus withdrawing the demand. This proposal may be regarded by some as visionary and impracticable. But something has been already done by the combined action of a few young men who have had the moral courage to brave the ridicule

of the many; and more will follow when the manliness of a God-fearing example is more generally recognised and appreciated.

But after all that can be said in favour of collective effort, we come back to the conclusion that without individual purity all other effort must prove vain. We may be indignant at the sins of others, but are we personally repentant? We may have generous instincts, but do we allow them to melt away in the crucible of temptation? Is our zeal accompanied by earnest self-denial, or does it expend itself in empty declamation or fruitless sentiment? Let each one answer these questions to himself: and if he can do so satisfactorily, I think he will be prepared to admit that the acquired habit of self-control is the secret of his moral strength. Therefore I would appeal to the young man to cultivate this habit early; for it becomes more arduous as each year passes by in unreflecting heedlessness. If he would keep his own mind and heart pure and help others to do the same, he must banish dissipating thoughts by wholesome occupation of mind and activity of body: and when these have become necessary for his happiness, he will have secured a valuable ally in contending for the mastery against the tyranny of animal passion.

I have intentionally refrained from dwelling on the moral and spiritual consequences of setting God's law at defiance by defilement of the body, which should be His temple, dedicated to His service. Can any honest man reconcile such defilement with his conscientious sense of what is due to himself and to society? Are impulses which are naturally among his most gentle and manly, to be diverted from their proper channel, and their spurious substitutes employed in corrupting and degrading the frail and thoughtless, so much oftener sinned against than sinning? Must we exclaim, with the indignant patriot, that "the age of chivalry is gone;" that a courteous regard for women and self-respect have lost their old refining sway? Will men continue to sear their moral sense by conduct which their unfettered conscience must condemn? I speak to those who acknowledge no higher standard than their sense of duty to themselves, to their homes, and to society. You *may*, unabashed, associate with

the thoughtless and worldly ; but can you, *thus*, greet a tender mother, a gentle sister, with unclean lips ? I know too well the ready excuses, and the fallacious answer to these inquiries. It is but for a season, and then I will sin no more. It is a vain hope that by your own will and in your own strength you can clear the ground of the weeds, the seeds of which you have yourself scattered in the virgin soil. They will spring up, unbidden, in after years to haunt your path : the dark thread of the past is woven in with the fair web of the present, and will, ever and anon, obtrude to mar its harmony and beauty.

To the nominal Christian I would appeal on higher grounds. He knows, and should acknowledge in his life, the condemnation of God's Word, oft-repeated and unequivocal, of impurity. He professes to believe the promise to the pure in heart, that "they shall see God : " and he also knows the final sentence on him who is impure, "let him be impure still ; " where the worm of an upbraiding conscience dieth not, and the fire of ungratified passion is never quenched. An awful doom indeed ; the survival of the unholy passion, whatever it may be, and the power of gratification gone for ever. "As the tree falleth so shall it lie." Shall we not cry aloud in this great Nineveh, flee whilst it is time ; flee from the wrath to come ; flee to the City of Refuge : and that stronghold is Christ.

It may be reasonably asked, what are my credentials, what my authority for many of the statements which I have put forward in this address. My answer is ; the life of a London surgeon, including many years of professional service to a large Hospital and our two leading Female Penitentiaries ; and the sympathy and interest which, during that time, were enlisted on behalf of many successive generations of young medical students. Now, in the late autumn of life, in retirement from its more active duties, and with leisure to take up and unravel the tangled thread of the past, I have ventured to accept the invitation of the Committee of our Society to address you ;—conscious, indeed, of the disparity between the overwhelming importance of my theme, and the feebleness of my appeal. But if this appeal find, by God's blessing, a response in some few hearts, I shall rejoice in this

justification of the Society's courage in thus ventilating an obnoxious and repulsive subject. This step may be censured by the sentimental; it *will* be condemned by the sensualist; but it is a fitting answer to the late indignant cry that has gone forth, for some antidote to the deadly poison of impurity that pervades every part of our social system, entailing physical degeneration, moral degradation and spiritual death.¹

¹ This address was delivered shortly after the appearance of the startling and revolting revelations which were published in the 'Pall Mall Gazette.'

RECENT ADVANCES IN NATURAL SCIENCE

IN THEIR RELATION TO

THE CHRISTIAN FAITH.

An Address delivered at the Reading Church Congress, October, 1883.

NATURAL Science and Revelation have, as their common object, the manifestation of truth : but in one respect they offer a noticeable contrast. Science advances by slow and cautious steps, feeling for light amid the prevailing obscurity, and sometimes deluded by an imaginary gleam, and led astray : whereas the Word of God is complete in its revelation of all that its Author intends to disclose ; containing, indeed, avowed mysteries transcending man's comprehension, but comprising in plain and intelligible language all that it is necessary he should be acquainted with for the chief purpose of his existence, the discipline of his life and the salvation of his soul.

It is needless to point out how much mischief has been inflicted on revealed religion by earnest defenders of the faith, (whose zeal has exceeded their discretion and their learning) in their attempts to reconcile that which is irreconcilable, by striving to establish harmony between the partial glimpses we have of natural truth, and the perfect knowledge we possess in the revealed Word of the Author of all Truth. The reaction of such ill-timed and incautious defence has been prejudicial to religion : it has not stayed the progress of scientific research, but has stimulated opposition on the part of its

disciples, whose efforts, by a natural antagonism, have been directed to pulling down the barrier which had been so unwisely raised to obstruct their progress or to discredit their pursuits. To this hostility, and a perception of its injurious influence on religion, I apprehend we may owe, in some measure, the awakening of the centres of education to the value of scientific training, and the necessity of providing instruction in the various branches of natural science. Be that as it may, it is a change fraught with incalculable advantage in every way, and especially in the interest of religion, by neutralising prejudice, and fostering sympathy between those whose pursuits have hitherto led them to view the same subject from such different standpoints, and thus to arrive at antagonistic conclusions.

It has been the destiny of every startling innovation on received opinions to excite opposition. In a certain sense this is wholesome. But there has been and is much needless expenditure of energy in resisting what men *believe* to be erroneous, and in upholding that which they believe to be true. The triumph of truth is certain, notwithstanding the restless conflicts respecting it. And these contentions very often exist, not because of any demonstrable incongruity between a scientific discovery and revealed truth, but because such discovery does not harmonise with the objector's preconceived notions, or does not come within the scope of his understanding. This injudicious opposition was exemplified by the bitter controversy and tyrannous oppression which the earlier discoveries in astronomy generated. Yet no one now considers the stability of Revelation endangered because the earth is no longer regarded as the centre of the universe. The angry recriminations which had their origin in geological discoveries may be in the memory of some of my hearers: but further examination of the questions under discussion has shown that here also the conflict of opinions admits of being reconciled by the adoption of a less literal and restricted interpretation of the Mosaic account of the Creation than that which had been previously familiar to us; and by giving due weight to the consideration that a revelation, declared in the language of modern science, would have been simply unintelligible at the time it was written. But, although it

behoves the theologian to examine dispassionately whatever may be advanced by the scientist, it cannot be denied that the difficulty of arriving at a satisfactory solution of apparent inconsistencies is enhanced by defective information on both sides: for it is exceptionally the case that the expert in science is also a theological scholar, or that the theologian is versed in natural science; and the training of the one prompts him to attach a weight to authority, which is rejected by the other in favour of observation: yet each may, perchance, consider himself qualified to deal with both sides of a disputed question.

I have said that the aim of scientific research is truth; and the natural consequence of this feeling after truth is to quicken our perceptive power and to enlarge our knowledge, thus enabling us to embrace more of detail in one comprehensive whole: and this generalisation implies a nearer approach to the final cause. Ought we to be surprised and disappointed that our view of a landscape is defective before we have reached a sufficient height to see its various component elements, and thus to correct our fallacious estimate of their relative distance and proportions? We should rather welcome every advancing step which brings us nearer to our desired resting-place, although at times the path may seem to lead us from it. It is in this spirit, as it appears to me, that the believer in Revelation should accept the progress of discovery in natural science: that is, in a firm persuasion that each successive unveiling of natural agency,—every combination of previously observed phenomena in one comprehensive category, and subject to one uniform law, is an advance towards the first cause of all:—and also convinced that, with more perfect knowledge, we shall be enabled to discern the harmony which *must* exist between the Word and the Works of God.

But, it has been objected that it is unphilosophical to assume that there is an intelligent First Cause and design in creation. Nevertheless, it cannot be denied that the principle of the conditions of existence, or, as it is commonly called, of *Final Causes*, has exercised a vast influence on the progress of biology. Even those who undervalue or reject teleology are insensibly compelled to avail themselves of its sug-

gestive help. This principle in natural science, involving *a priori* considerations, was advocated by Cuvier in the early part of this century, and strongly opposed by his contemporary, Geoffroy St. Hilaire :—the former maintaining the doctrine of design in organisation, and the latter altogether repudiating it, and especially guarding himself, with the humility of agnosticism, against the imputation of ascribing any intention in creation to God ; whilst he endeavoured to establish the—as it then appeared—opposing doctrine of unity in the organic plan of the animal kingdom. These eminent zoologists present us with typical examples of the advocates of these doctrines, which had so wide-spread an influence in their time and subsequently. I speak of them as opposing doctrines because they were so regarded by their several partisans ; and the contention was sufficiently sharp to produce, for a time, a coolness between Cuvier and St. Hilaire.

I have no intention of discussing the respective merits of their views, but refer to them rather to show that there is no real antagonism between them, and that they exemplify the relation which accepted or disputed theories may hold to each other, when included under a higher and more comprehensive generalisation. But such fresh discovery is not to be regarded as negating those inferences which had been previously accepted. We see, for example, that certain phenomena have an evident association with some beneficial result, and are satisfied to rest on this relation as direct cause and effect ; but, by-and-by, we discover that the phenomena in question are referrible to a law which had no relation to this beneficial result : yet it is no reason for rejecting our first conclusion because the second is also true. The tawny hue of the lion, the spots of the leopard, and the stripes of the tiger, although claimed as exemplifying the principle of the survival of the fittest, are no less beneficial to their respective owners, by concealing them on the arid desert, amid the leafy tree branches, or in the tangled jungle. If this be so, are we justified in refusing to believe that, because it has pleased the Designer of the universe to accomplish His purposes through the instrumentality of certain fixed laws, the beneficial results of those laws, and uniformity in plan of the observed outcome of their operation were not a

part of the design, or that our failure to discover the adaptation of means to an end is a reason for assuming the absence of such purpose? I think not. It rather behoves us to wait patiently whilst we work, instead of rashly assuming that we have already reached the limits of generalisation, or that this newly-discovered law is to be accepted as exclusively explanatory of all the phenomena in the investigation of which we are engaged.

The doctrine of organic Evolution seems to me to illustrate these remarks. If we adopt it in its integrity, we are not, therefore, compelled to deny the principle of Design, or even that of Unity of Type. There is no necessary inconsistency in these doctrines, though we may admit that the higher and more comprehensive law is that which has been most recently advanced. I do not propose to discuss in detail this doctrine as applied to living organisms; but simply to glance at its present aspect in relation to revealed truth, and its acknowledged claims on our consideration.

I may remark, in passing, that the questions of spontaneous generation and the origin of life are not reached by Evolution. Especially since the grand advance in physical science by the discovery of the conservation and convertibility of force, an opinion has been entertained by some biologists that vital phenomena are due to a combined operation of physical and chemical agents: but neither facts nor reasoning have sufficed to discredit the generally received view that vitality is an inherited endowment *sui generis*, or to sustain a belief in spontaneous generation.

Biologists seem to be almost unanimous in adopting, though not without reservation in some instances, the leading facts and reasoning of Darwin; by whom it is affirmed or implied that the law of Evolution will ultimately suffice, with its supplementary conditions, to explain all the complex and varied phenomena of organic form and function. An analogous claim has been asserted, not infrequently, on behalf of other discoveries, and has been maintained by their authors and advocates with pertinacity, until subsequent investigation has demonstrated the fallacy of a too hasty generalisation. No doubt the advance in biology, which is due to the writings of Wallace, Darwin, and others of the same school, is great:

but, on strictly scientific grounds, it is assuming more than the theory of Evolution is entitled to, when so much is exacted on its behalf.

The special feature of this doctrine is, that all living organisms are derived from one common source, and that their varied forms are due to Natural Selection, through a long and uninterrupted series of changes, and that each organism is influenced solely by its existing demands in relation to its environment. The evolutionist who refuses to recognise design in the development of his system—and there are such—is bound to supply a more rational explanation of the initiative activity of protoplasm, and the diversified bias of cell-development, culminating in adaptations of organic structure to function, and to beneficial extrinsic arrangements which meet him at every turn. Such perverse rejection of Divine purpose in no way strengthens the Evolution theory; for, as already remarked, the explanatory sufficiency of one principle, if admitted, does not invalidate the other:—their parallel manifestation presents no difficulty, and their divorce is, to say the least, gratuitous. Moreover, it may be observed that the atheist alone can consistently refuse his assent to design in Creation; for our conception of a Supreme Being is inseparably allied with Power, Knowledge, and Will; and the suggestion that these attributes have been exercised hap-hazard and without plan or intention is inadmissible. How existing results have been worked out, whether by prolonged steps through incalculable ages or instantaneously, does not affect this question. Neither the lapse of countless centuries, nor the struggle for life, nor inheritance, nor natural or sexual selection, in any degree weaken, far less subvert, the doctrine of final causes. But if the initiative agency of creative intelligence be admitted, it seems unreasonable to limit the sphere of that agency. It is true that the universe is governed through laws which are not subject to variation; and we know also that organic life is developed and maintained in accordance with similar laws: but it is no controversion of these laws—it may be, for aught we know, a necessary part of them—if a fresh impetus or direction is imparted to certain forces, which is productive of different results.

Again, the law of Evolution excludes the idea of creative

interference; yet the question of such interposition, in certain stages of the world's history, may not unreasonably be weighed against the ingenious assumptions which Evolution, in its plenary acceptation, is compelled to advance, as data for its bold conclusions: it is a balance of probabilities; and I am not disposed to quarrel with those who prefer to rest in the belief in such interposition, rather than, with our present light, to build on scientific conjecture, and to force the facts we witness to range themselves under the despotic law of Evolution. The lapse of time claimed for this doctrine is such (to use Darwin's words) as to be "utterly inappreciable by the human intellect;" and the record of geology is far too imperfect to satisfy its requirements; "for the number of specimens in all our museums (I again quote the same author—*O. of Sp.*, 548—) is as nothing compared with the countless generations of countless species which certainly have existed." *Certainly*, I may remark, if the theory be accepted without reservation; yet this geological defect is an admitted difficulty; for we ought, in order to make this evidence complete, to connect the broken links, to fill up the blanks, and to find "great piles of strata of organic remains long before the lowest bed of the Silurian systems was deposited."

The evolution of the Eye seems to have struck Darwin as embarrassing: and it certainly is not easy to appreciate the utility of this organ during its lengthened period of incubation or progressive development, and therefore of optical imperfection. But this serves to exemplify a class of difficulties which are met by the argument—more satisfactory in most instances than in that of this special sense—that the partially developed state of its various organic components was, in each successive stage, in conformity with, and adapted to, the existing constitution and requirements of the whole.

Of *Man*, as the culmination of organic Evolution, I have a few words to say.

We should dismiss, as unworthy of a philosophical spirit of research, the prejudice engendered by the assumed alliance claimed for us with the anthropoid apes. If the consanguinity had been traced to some nobler animal the popular objection would probably have been less. It really matters not whether

we are descended from such ancestors or were formed out of the dust of the ground, if we feel that God was our creator, and intended us to be what we are.

This final step in Evolution is regarded by many biologists as an essential sequel—a logical necessity, if we accept the earlier teaching and the other propositions of the doctrine.

Science and Revelation agree in assigning to Man the final place in the order of existence: and that he was once gifted with a spirit of purity, holiness and love, in the likeness of his Divine Creator, is a revealed truth which no scientific speculation can set aside without rejecting Revelation. Immortality is beyond the reach of evolution: the lapse of millions of years is no approach to an eternal future: and our instinctive shrinking from annihilation, the value we place on our personal identity, and the natural yearning of the heart for a higher and better estate and a more durable existence, though outside the range of physical enquiry, cannot be ignored. If man, therefore, is immortal, this endowment must have been conferred, and could not have been otherwise acquired. Granting this gift, it is difficult to escape the inference that moral responsibility was associated with it, as a necessary adjunct. Even conceding the possibility that Man's *intellectual* attributes might be evolved from the corresponding faculties of animals, an admission of his immortality and responsibility renders it not unreasonable to believe that his intellectual endowment was also a direct gift from his Creator. Apart from any qualifying considerations the question is again one of balance of probabilities. But there are many such considerations which seem to throw the weight in favour of direct endowment. I will not contrast Man's intellect with that of animals: this is a familiar subject; and, although observation has induced me to allow a higher position to animal intelligence than is generally conceded, it appears to me that there is so impassable a barrier between them, so wide a chasm without a bridge, that the doctrine of Evolution, as here employed, is unsatisfactory. I will mention only one difficulty, which has its bearing also on physical evolution: and that possesses the greater weight, by being placed at the head of what the principle of natural selection *cannot* do, by one who styles himself its "ardent advocate."

The capacity of the skull, and therefore the size of the brain, is an unquestioned measure of intelligence, not only in contrasting Man with the lower animals, but in comparing man with man ;—reference being made specially to the development of the cerebral hemispheres in relation to general bulk, and some allowance being conceded for quality and complexity of arrangement. Yet Wallace has pointed out that, in our largest collections of national skulls, the variation in capacity is comparatively trivial ; and—which is more to the purpose,—that the most ancient skulls closely resemble those of the existing race of man ; that the probable contemporary of the mammoth and cave-bear had, to use Professor Huxley's words, “a fair average skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage.” And this development was co-existent, apparently, with savage habits, as suggested by the strong ridges on the jaw and other bones, indicating great muscular strength. In comparing the brain capacity of the anthropoid ape with that of man, savage and civilised, the proportionate quantitative measurements given are 10 for the ape, 26 for the savage, and 32 for civilised man. The largest specimen of the gorilla yet known had a brain of $34\frac{1}{2}$ cubic inches : yet, any adult male skull with less than 65 cubic inches of brain, or measuring less than 19 inches in circumference, can belong only to an idiot. It is with no surprise then that we find Mr. Wallace, in this very interesting chapter of his work on *Natural Selection*, arriving at the only conclusion admissible from these premisses, that, in his large and well-developed brain, the savage “possesses an organ quite disproportionate to his actual requirements,—an organ that seems prepared in advance only to be fully utilised as he progresses in civilisation ;” and which “seems to prove the existence of some power, distinct from that which has guided the development of the lower animals through their ever-varying forms of being.” Such is his reasoning and such his verdict. No less interesting and instructive are the same author's remarks on the denuded body, the erect posture, the form of the feet and hands, and the voice of man ; in the existence and distinctive characters of all which he recognises the insufficiency of natural selection.

If this be so, we may ask whence came these human characteristics, and how was it that man acquired a brain of useless size and complexity ; and how came it to pass that he preserved it when his surroundings and requirements ought, according to the principle of natural selection, but retrogressively, to have degraded him in the scale of creation ? There is a close resemblance, both organic and functional, as well as developmental, between Man and other vertebrata ; and analogy seems to point to the conjectural inference that he must be the culmination of a system which, without him, would be incomplete. But as yet this assumption rests on no reliable evidence. I therefore think it must be admitted that Evolution has no *present* scientific pretension, which can be regarded as admissible, to include Man, morally, mentally or physically, in its vast and varied family. I might even venture further by saying that the early history of man, so far as yet revealed to us by science, might, not unnaturally, induce in some minds a distrust in a theory which is compelled to rest so much on surmise and possibilities. The failing proof may be furnished at some future day, and we may await patiently and fearlessly what that future shall unfold.

Recent attempts have been made, with some success, to show that the Divinely dictated account, or retrospective vision of the creation, by Moses, permits of an interpretation much more in conformity with astronomical discoveries and geological record than was formerly supposed ; and therefore with the doctrine of Evolution, so far as it is supported by geology. Even if time permitted, and my acquaintance with these sciences qualified me for the task, it would be beside the special purpose of this address to discuss such speculations, which, we may anticipate, will assume a more definite form and higher value as the circle of our information expands. Moreover, I should be sanctioning that which I have already deprecated, by a premature attempt to harmonise revelation with a branch of natural science, which, though opening up a large field for study, and a valuable guide in biological research, is still too defective in its data and hypothetical in its reasoning to justify its erection into an exclusive system, claiming finality, and resting on the assumed

lapse of countless ages ; and to which investigation in other directions can be only ancillary, and must be subordinate.

And here I might close this address, but that it seems desirable I should indicate, in a few words, the salient points to which I have desired to draw attention.

The recognition of a purpose in Creation and of Unity of Type in development is in no way inconsistent with the adoption of the theory of Evolution, which includes both teleology and morphology in its more comprehensive embrace ; and this proposition is sustained by the moral certainty of such purpose existing ; as the conception of an Omniscient and Omnipotent Creator, working without plan or design, is a paradox. Moreover, an initiative scheme, including periodical creative acts, is not incompatible with a belief in intervening organic progress by evolution ; though I cannot say that such a hypothesis commends itself to my reason or to my conception of the Divine perfection. It implies supplemental agency, and therefore initiative insufficiency, thus degrading the Divine attributes to the level of our own finite capacities and limited resources. I would rather contemplate the possibility of our being permitted some day to reach a higher standpoint, whence we may see and understand that which is now shut out from our view and unintelligible ; a further step, possibly, in generalisation, which shall manifest yet more of the glory of our Heavenly Father, and thus draw us nearer to Himself. But, be that as it may—and I am sensible how fruitless are such speculations—it appears to me that the theory of Creation we have been considering, resting on its own demonstrable evidence, tends in the most direct way to support the view, that the outcome of this world's creation, with all its complex machinery and wondrous arrangement, both organic and inorganic, must have been planned from the beginning ; that its harmonious evolution was foreseen and predestined when the earth was without form and void ; and that all proceeded on a fixed and unerring plan, in subservience to laws which imply a lawgiver. And is not our conception of the power and wisdom of the Creator exalted rather than impaired by such a contemplation ? It were indeed presumptuous to contrast one mode of action with another in the Omnipotent Author of all : yet,

to our finite apprehension, the progressive evolution, in accordance with a fixed law, of animal life in its varied forms, till they attained their existing perfection of structure and special organisation and relative adaptation to their surroundings, seems to attest a Creator's attributes with even more convincing force than if the same results had been accomplished at once, in their completeness, by His simple fiat. And surely the devout Christian may welcome, with unshrinking confidence, the light which thus manifests His power and goodness, as another streak in the dawn of a still distant day, when creation's hymn shall be sung without a jarring note of discord.

God said in the beginning, "Let there be light," and He encourages us to seek for, and to live in the fruition of, that light, spiritually and intellectually as well as materially. It is certain that the shadow of fallibility *must* ever rest on man's pursuits ; and the perversion of partial knowledge *may*, for a season, obscure the truth. But, as the mists of early morn are scattered by the rising sun, so may we hopefully anticipate that these transient clouds will be dissipated by fuller revelations and a more perfect knowledge, till shadows vanish in the light that "shineth more and more unto the perfect day."

The time allotted for the delivery of this Address was fifteen minutes.

THE HUNTERIAN ORATION, 1875.

BY THE PRESIDENT.

MR. VICE-PRESIDENT AND GENTLEMEN,—

It has been my lot, in common with many whom I have now the privilege of addressing, to be present on several occasions when this Oration was delivered in honour of the great founder of our Museum. Yet, even on this the forty-seventh commemoration, I feel it would be unbecoming to deprecate criticism by pleading lack of novelty, or exhaustion of materials for the task ; for the achievements of such men as John Hunter have no defined limit. His master-mind has communicated in various ways a new direction and impulse to investigation, thus influencing, immediately or imperceptibly, the development of the sciences he cultivated ; and that influence is still felt and acknowledged, and it will yet endure long after the direct association between the originator of the work and its ever-expanding results shall have been obscured or forgotten in the lapse of time.

Many of these Addresses possess a peculiar interest of their own, apart from the subject of them, which I cannot hope to impart to mine ; for they have been composed and spoken by men on whom the mantle of Hunter has fallen not unworthily ; and in them we recognise the reflection of many of his special characteristics in refined and accomplished minds,

and an epitome, as it were, of the views and purposes of their authors in the cultivation of our profession.

More than one generation has passed away since Hunter lived, and there are but few, I suppose, who are my juniors, who can recall the aged face, beaming with intelligence and kindness, of our first Conservator. It is difficult to dissociate Mr. Clift from this theatre, and especially from this occasion, which was one of peculiar interest to him, who was, at the time to which I refer, the only remaining representative of the master whom he had served in his youth with single-hearted devotion—a veritable link with the great man, whose memory and everything pertaining to him he regarded with the fondest reverence. And in his track follows a succession of illustrious names, identified with the progressive moulding and fashioning of the rude chirurgery of former times into the present relative perfection of modern scientific surgery.

This contemplation of the past, which seems so naturally to present itself on this occasion, is one which evokes very mingled feelings; for so many are already gone, passing away, one by one, from this busy scene. The familiar face is no longer present save to the eye of memory; the voice which gave utterance to words of fervent eloquence is hushed; the tutored intellect and skilled hand are both at rest; but their example, their teaching, remain as an heir-loom to future generations.

Blending, perhaps unbidden, with this retrospect comes the consciousness that our turn must soon arrive, to quit the stage on which we now move and perform our allotted task, and to be numbered with those whose memory is cherished and revered by few or many, as the responsibilities of that task, and the sacred trust of influencing others for good, have been appreciated and realised.

In harmony with these reflections, I proceed to comply with a condition—I may designate it a painful privilege, associated with the present occasion—that some mention should be made of the loss sustained by this College, in the death of such of its members since the last Oration was delivered as shall, in the words of its founders, “have contributed by their labours to the improvement or extension of

chirurgical science." In this review I will observe a chronological order in briefly commenting on each eventful life.

Richard Partridge, who was long and intimately associated with our College, was born in 1805, and died on March 25th, 1873. He commenced his education at Birmingham, and completed his studies at St. Bartholomew's Hospital, receiving his surgical diploma in 1827. The first public appointment he held was that of Surgeon to the Charing Cross Hospital. When King's College was founded, Mr. Partridge was elected Demonstrator of Anatomy; and his ability as a teacher subsequently procured for him the Professorship of Anatomy, vacated by Mr. Mayo. When King's College Hospital was opened, he became one of the surgeons attached to it, in virtue of his office in the College. In 1852 he was elected a member of the Council of this College, and afterwards a member of the Court of Examiners; and in succeeding years he held office as Vice-President and President, delivering the Hunterian Oration in 1865. He also held for many years the Professorship of Anatomy at the Royal Academy, in succession to Joseph Henry Green.

Richard Partridge's reputation was especially associated with his ability as a teacher of anatomy. In his prime he had few equals as a lively and engaging lecturer, and enjoyed much popularity with his pupils. Beyond this he has left scarcely any record of his professional work to posterity. In social intercourse he was always cheerful; and all who enjoyed that intercourse are familiar with the dry humour with which he delighted to tell a racy story or to retail a *bon mot*; indeed he seemed to have an inexhaustible store of these good things, which, in his hands, rarely degenerated into anything which savoured of vulgarity or personal unkindness. He had a cultivated taste, and was endowed with a large share of tact and many sterling qualities. When we missed him from our meetings we all felt we had lost a genial companion, a staunch supporter of the College, and a valued friend.

The name of Joseph Jordan is associated with that of his contemporary and fellow-townsmen, Mr. Turner, as an energetic surgeon who introduced professional teaching in the

provinces, when the oldest amongst us were learning the rudiments of general education, before we reached the dignity of our teens ; and he was long associated with the Manchester School of Medicine. Mr. Jordan was surgeon to the Infirmary of that town for thirty-three years, and died at the advanced age of eighty-six in March, 1873.

John Bishop did not enter the medical profession until he had attained his twenty-fifth year. He was a pupil of St. George's Hospital, and obtained his diploma in 1824. He was elected as a member of Council in 1849, and Hunterian Orator in 1859. Mr. Bishop's name is especially associated with his work on the 'Human and Comparative Anatomy and Physiology of Voice,' on which he wrote several valuable papers, which obtained for him the Fellowship of the Royal Society, and two prizes awarded by the Royal Academy of Sciences of Paris ; and he acquired considerable practice in the special department of treating impediments of speech. He possessed much energy of will and soundness of judgment, as well as literary and scientific tastes ; and was remarkable for the accuracy of his observations and his power of applying his mathematical attainments in all investigations in which he was engaged, and which admitted of precise demonstration. He died in September, 1873, in his seventy-sixth year.

The many physical obstacles which impede the progress of medical science in our Eastern Empire, where, nevertheless, its diffusion by teaching is so much needed, enhance the merit of self-sacrificing toil in its behoof. All honour, then, to such as Henry Charles Cutcliffe, whose martyrdom to science in India evokes our sympathy and claims our admiration. The late acting Professor of Anatomy at the Medical School of Calcutta died, after four days' illness, in October, 1873, at the early age of forty-one. His friend and colleague, Dr. Fayrer, who was, of course, well acquainted with his merits, thus speaks of him :—" He was an officer well qualified to uphold the dignity of his service and profession, and to those who had the privilege of knowing him well a true and loyal friend. His place will not be easily filled, nor will his memory readily fade in the college where he taught so well."

Thomas Turner was, in one sense, the father of our

Council ; for he was the senior of all his colleagues in years, though not in service. He became a member of this College in 1816, and as early as 1824 he took an active part in founding the Manchester School of Medicine, which is the first provincial school that had a recognised curriculum. For twenty-five years he acted as Surgeon to the Manchester Infirmary, and was associated with almost every good work in any way allied with his profession in that great city. Mr. Turner is the author of several works of professional value and interest.

Although for many years a provincial member of our Council, Mr. Turner did not take a very active part in the management of its affairs ; but he was sincerely esteemed by us for his personal qualities, as well as for the traditional interest associated with his name. He was a good man in the highest acceptation of that word. His strong religious convictions and benevolent impulses were not dissipated in sentiment, but were manifested in his daily life. Gentle, courteous, and truthful, he was yet firm in the reproof of vice, as he was thoughtful and anxious in promoting what his conscience approved ; and his energy seemed equal to his duties, until at last, for a brief period, physical infirmity compelled him to relax ; and he expired, at the close of 1873, at the ripe age of eighty. No wonder that such a man was respected and beloved in his life, and that his loss has left a blank in the hearts of the many in whose service the vigour of that long and active life had been unselfishly expended.

Thomas Wormald commenced his profession in 1818, as an articled pupil of Mr. Abernethy, at St. Bartholomew's Hospital, and with that institution he retained his connection until his retirement from office as surgeon at the age of sixty-five. He first became a member of Council in this College in 1849, and subsequently filled the offices of Vice-President, President, and Hunterian Orator ; he was also for many years a member of the Court of Examiners. Shortly after his retirement from his hospital duties, Mr. Wormald withdrew from London, and spent the remainder of his life in rural retirement. He died on December 28th, 1873, of cerebral apoplexy, in his seventy-second year, whilst on a visit to a sick brother in Yorkshire.

It is said that there was considerable sympathy between Mr. Wormald and his eccentric master ; and those who can recall, as I just can, some of the peculiarities of Mr. Abernethy, may readily credit that such was the case. The honest bluntness of the pupil would commend itself to one who never cultivated amenity of manners ; and as avowed eccentricities are usually apt to be exaggerated, it seems probable that such was the case in this instance with both master and pupil. Mr. Wormald was successful as a teacher of anatomy, an accurate observer, and a good surgeon ; but, like Mr. Partridge, he has left but little record of his work or of his experience. His kindness of heart was evinced in his relation with the poor and suffering whom he tended ; and many have borne witness to his liberality in dispensing a private income, which rendered him independent of his profession. A graphic and feeling sketch of his life will be found in the last volume of the ' St. Bartholomew's Hospital Reports,' by one of his former pupils, and now the Senior Surgeon to that Hospital.

Surgeon-Major John Wyatt died at Bournemouth in January of last year, after a protracted illness, the fatal issue of which may be attributed in part to the hardships he had voluntarily borne in the protracted siege of Paris. He entered the army in 1851, and served in the Crimea, remaining with the army until the fall of Sebastopol. His eminent services at this time recommended him to the Government, when a Medical Commissioner was appointed to join the head-quarters of the French army in the Franco-German war ; and he finally shared all the privations to which the population of Paris was subjected, devoting himself with unwearied energy to the relief of the wounded and suffering.

Surgeon-Major Wyatt was the deserving recipient of many honours, both foreign and domestic, including the Companionship of the Bath ; and an impressive tribute to his merits is afforded by a feeling eulogium, contained in the regimental order of the Coldstream Guards, where he was so well known and sincerely lamented.

It is only a few months since Edward Cutler, one of the earliest members of our Council under the last charter, passed away from among us at the age of seventy-seven.

He was born in 1796, and was destined at an early age for the sea ; but his health not being sufficiently robust, he became a student at St. George's Hospital, and received his diploma here in 1820. For a few years he served as assistant-surgeon in the Life Guards, and subsequently was associated with Sir Benjamin Brodie as his private assistant. With St. George's Hospital he was connected as surgeon for eighteen years, after serving for several previous years as assistant-surgeon. He was also for some years Surgeon to the Lock Hospital. To his professional qualifications, aided by the alliances he formed in his early career in the army, and to his capacity for making friends, Mr. Cutler owed the popularity he acquired and the esteem in which he was held.

Joseph Swan was one of the last members of our Council who had the privilege of retaining his seat for life. He commenced practice in his native city (Lincoln) after completing his studies at the Borough Hospitals and obtaining his diploma here in 1813, and was for several years Surgeon to the County Hospital. During this period Mr. Swan wrote two treatises, which obtained for him the Jacksonian Prize of this College in 1817 and 1819, respectively for 'Diseases and Injuries of the Organ of Hearing,' and for the 'Treatment of the Morbid Local Affections of Nerves.' He then devoted his leisure time to dissection, and in 1822 he successfully competed for the first Collegiate Triennial Prize, for a minute display of the spinal nerves from their origin to their terminations. Again, in 1825, he was the prize essayist when the subject was a similar dissection of the cerebral nerves ; and the preparations which accompanied the dissertations still enrich our Museum. The honorary Gold Medal of the College was awarded to him ; and shortly afterwards he removed to London, and was elected a member of our Council. Mr. Swan was essentially a studious man of retiring habits, who passed much of his time in his favourite pursuit, dissection. By his anatomical writings, as well as by his actual work, he has added to the reputation of this College. He died, unmarried, at Filey, in Yorkshire, in October, 1873, at the age of eighty-three.

Another octogenarian, Sir Ranald Martin, C.B., died on November 27th in last year. He was a native of the Isle of

Skye, and obtained his education at St. George's Hospital and the Windmill-Street School of Medicine. His diploma dates from 1816, and the year after he obtained it he sailed for Calcutta in the Company's service as assistant-surgeon. After much active service in the field, in which he evinced great personal bravery and readiness of resource, he finally settled at Calcutta in 1826, where he married and was appointed Presidency-Surgeon. Whilst engaged in work at the native hospital, he introduced the method, now universally adopted, of injecting hydrocele with iodine. He enjoyed a large practice in Calcutta, but his health compelled him to return to England in 1840, and he continued to follow his profession in London until within a short period of his death. Sir Ranald has entitled himself to the gratitude of the profession by his contributions to the literature relating to tropical diseases, and for his support of sanitary measures generally. His tall figure and military bearing were familiar to most of us. He was a genial man, a warm friend, and a faithful public servant.

The last loss to our College which I have to record occurred on the closing day of last year, when Francis Kiernan died in his seventy-fifth year. He is claimed by St. Bartholomew's Hospital as one of her sons, and there he soon evinced his taste for anatomy. Shortly after receiving his diploma he gave lectures, for a short period, on this subject in his private residence. His researches on the minute structure of the liver were commenced about this time; and their publication justly obtained for him a world-wide reputation; and for these discoveries the Copley Medal of the Royal Society was awarded to him. In 1850 Mr. Kiernan first became a member of our Council, and retained this office for many years; he was subsequently a member of the Court of Examiners. After serving the office of Vice-President of the College in 1864, he was seized with paralysis; and although he recovered in great measure from this attack, his official connection with us then ceased.

Mr. Kiernan must ever hold an eminent position among English anatomists; and his name will be especially associated with the discoveries to which I have alluded. The accuracy and care with which his observations were conducted are

the more remarkable from the imperfection of the instruments which were available at the time that he was engaged in his researches ; and we must not measure their value by their bare and direct results, for an impulse was thereby given to minute investigation, especially of the structure of glands, which has since been so fruitful in the hands of others. I am informed that Mr. Kiernan's attainments as a pathologist were of no mean order ; and it is to be regretted that these will probably be lost to the profession, in consequence of the disability from deteriorated health which so long preceded his death.

It is, Sir, I believe, an admitted truth in ethics that the practical lessons afforded by an earnest man's daily life are worth far more than his doctrinal teaching, however orthodox that may be ; they are, no doubt, more trustworthy, because more truthful and undisguised by sentiment. And I think we may often observe the same fact obtaining in relation to intellectual teaching ; probably the lessons likewise in this case are not less impressive because imparted unconsciously or without premeditation. I have been led to make this remark by reflecting how much we are indebted to Hunter for exemplifying, in all his pursuits, the true spirit of our greatest of modern philosophers. I do not suppose that he had studied Bacon, and yet there never was a more faithful exponent of the Inductive method of reasoning than Hunter. His perception of its value in the investigation of the works and laws of nature was intuitive ; his foundations were broad and deep, and caution and vigour were conjointly exercised in raising his superstructure. I do not offer any special illustration of this assertion, because every line he wrote, every preparation he made, attest its truth ; and it is unnecessary to insist on that which, I apprehend, no scientific surgeon, no physiologist, would hesitate to admit. But it is well, in attempting to estimate our debt of gratitude to Hunter, that we should not only appreciate the substantial work he did, but also fully realise the spirit in which that work was accomplished. And if that spirit had not been deeply graven on the glorious monument of which he laid the foundation within these walls, and read aright by his suc-

cessors, the lessons inculcated by his thoughtful, truthful life would have been comparatively fruitless. Happily, we have no self-reflection on this score; and we have only now to enter the enlarged depository of our treasures, and to observe their ever-expanding richness, their beautiful arrangement, and the perfection of their keeping,—results attained by the exercise of a liberal policy on the part of the Council, but under the conservative rule of Professor Flower and his predecessors;—we have only now to make this survey to feel assured that the spirit which influenced its first author still survives, and that he himself could have devised or desired no more appropriate recognition of the principles which prompted the conception and sustained the vigorous prosecution of the great work which he initiated.

In thus acknowledging the services of those who preceded us in this important trust, I venture to express a hope that, in the future, the interests of this College will continue to be guarded and its Museum cherished, with the same jealous care as heretofore. The present is a crisis in our existence. Through good report and evil report this College has advanced to eminence, and I trust to usefulness commensurate with its prosperity; and it is now in contemplation that it shall surrender an independent agency it has exercised so long, to co-operate with other public bodies in constituting an examining board for a qualification to practise. I sincerely trust that this proposed arrangement may realise all that is expected of it; for the past history of this College, and its early struggles for independence, its noble aspirations, its great achievements, are dear to me. But who shall forecast its future history when that independence is gone? Whatever it may be, we shall still need the support of all who possess our diploma; and we claim the chivalrous exercise of their franchise by the constituents of an institution which, in its traditions and as a home and nursery of scientific surgery, is second to none in the world.

To return from this digression. It would not be difficult to show that Hunter's writings have, in like measure, influenced the labours of his successors in the development of surgery, by raising it from an empirical handicraft to a scientific art; for he exemplified, in a way and degree which

had never before been attempted, the natural association, the necessary alliance, between physiology, pathology, and the treatment of disease ; and it may be justly affirmed that, by his logical demonstration of this relation, he stimulated the cultivators of medical as well as of surgical practice to seek for a more correct interpretation of the phenomena of disease, and thus to conduct its management on more enlightened principles. I do not hesitate, therefore, to express my conviction, that the truly *Philosophic example* of this great man is the highest and most lasting title he has established to our recognition of the widespread service he has rendered to our profession in all its branches.

Scarcely inferior in importance is the lesson of *Humility* which Hunter inculcated by his simple faith in Nature. He never troubled himself about the crude theories and sophistical learning of the schools, but put them aside as valueless, because not tested by an appeal to facts. But I refer now more particularly to the modern recognition of Nature's resources in the cure of disease, which his work and example did so much to establish. It is difficult to estimate the mischievous consequences of confounding the phenomena attending a disease with the disease itself, and it may be feared that this is a rife source of the injudicious and empirical practice which still too widely obtains in its management ; for the conviction is not yet extinct that, in disease, Nature is to be regarded as an enemy to be combated, rather than as a friend with whom we may take counsel, and whose efforts it is our duty to watch and assist, rather than to thwart and obstruct.

I have confidence in the means which Nature uses, and her mode of using them, though I know that her resources sometimes fail. It is the surgeon's duty to watch such opportunities of interposing, to supplement this inherent disability, by affording mechanical assistance where vital efforts are abortive, by directing misguided energy, and by sustaining failing power ; but rarely, very rarely, by counteracting her tendencies or rejecting her suggestions.

In speaking of the phenomena of disease, I mean the attendant signs and symptoms, which are usually but the expression of a natural effort to eliminate a poison or to effect

a cure. The swollen joint in gout or rheumatism, the suppurating lung in tubercular phthisis, the special characteristics of the various types of fever, are alike indicative of the strife which is at work between the bane and its natural antidote. And so it is likewise with the diseases and injuries which fall to the surgeon's province to treat ; and the fact that these curative efforts are sometimes abortive, and sometimes destructive in their excess, in no degree invalidates the correctness of this view. The diffused light of day, the gently distilling dew of night, the refreshing breeze and irrigating shower, are Nature's agents for sustaining and renewing life and health in the vegetable world ;—the hurricane and storm and flood are exceptional, and often destructive. And these lessons have their application in the management of disease, and their exemplification in the beneficial results which are witnessed in the more patiently expectant and less heroic treatment of the present day—a treatment based on that humility which ever accompanies increased knowledge of and confidence in Nature's resources.

But, it may be urged, this confidence has no justification in the frequent fatality of premature organic disease witnessed in our hospitals—indeed, in every class of life. I would rejoin by affirming that natural organic defect is not to be credited with these results. Investigate the history of such cases, and mark how loyally, how unremittingly, the heart and ancillary lungs, the brain, and especially the eliminating organs, have toiled and striven to keep pace with the thoughtless and vicious demands made on them by excess of all kinds ; until at last some over-taxed and willing labourer in the common cause gives way, and the whole machinery is thrown out of gear and ruined. I say especially the organs of elimination ; for it behoves us not to misapprehend the efforts made by them, often vicariously and abnormally, in a prophylactic or curative direction ; and to beware lest we mistake such benign assistance for local functional derangement or disease, and treat it accordingly, to the serious detriment or more rapid destruction of our patient. Yet, I apprehend, such thwarting of Nature's kindly purpose does sometimes occur ; and that the abnormal activity or local flux is not recognised in its true character, because its

bearings,—its relations both as to cause and effect,—are not appreciated or studied in their general or constitutional aspect.

In contrasting the therapeutics of the past and present generation, much has been said and written respecting the change in type of disease and the physical constitution of our race, to explain—without condemning our predecessors, or too ostentatiously parading our own enlightened views—the results obtained in such conflicting ways and by such different means. This may be so; but have we sufficiently taken into account the liberty which is now accorded to Nature to work in her own way, without being thwarted and coerced at every turn? Decisive interference is sometimes essential in surgery, but Nature will often resent hasty violence which anticipates her slow and gradual method of relief; and abiding success will in many cases wait on patient watchfulness, that is denied in the issue to officious meddling, which is more seductive, and therefore more mischievous, because of the temporary success which may attend it.

The modern practice of medicine, as well as of surgery, abounds with proofs of this salutary influence. I may instance the copious dilution of soluble medicines. We had long witnessed the beneficial effects of the natural medicinal waters of our own island and of many continental baths and springs, but we have been tardy in recognising the value of prescribing our medicines in the same diluted form. The adoption of this practice—so far as it is adopted—is no doubt more consonant with our present advanced physiological knowledge, and our acquaintance with the physical law which governs the absorption of fluids, and their transmission to the circulation; but it is chiefly due, I think, to a more careful observation of Nature's gentle methods; for we thence have learned that the required elements will be thus incorporated by assimilation, which would be passed on by the irritated bowel, or refused osmosis, if introduced in a more concentrated form. The combination of some of the less soluble medicines with food is to be commended for the same reasons, and in many instances with equal profit in their action.

In surgery I may venture to speak with more confidence, for its greatest conservative triumphs have been suggested and matured by the study of those indications which natural curative efforts afford. Pre-eminently may the principle of Rest, in the treatment of many surgical diseases and injuries, be cited in illustration of this remark. I mean absolute and continuous repose, such as Nature exhausts her resources to obtain, though often ineffectually, on account of the indocility of her patient, or the meddlesome interference of the nurse, and sometimes of the doctor. Abscess, joint-disease, aneurism, necrosis, hæmorrhage, ulcers, and injuries of all sorts, exemplify the value of rest. I remember, many years since, being impressed with a remark of Sir Benjamin Brodie, in a consultation on the treatment of a diseased joint. In reply to some suggestion or inquiry, he thrice repeated emphatically the monosyllable "rest;" and in truth it is only in exceptional cases that active measures, as they are termed, are justifiable in this class of diseases. Happily this subject, under the title of 'The Influence of Physiological and Mechanical Rest in the Treatment of Surgical Diseases,' has had an able advocate and exponent in a late President of our College, whose lectures, delivered in this theatre, exemplify not only the great value of this passive treatment, but also the careful observation and practical experience of their author.¹

The modern treatment of aneurism, due especially to Hunter, is based on the observation of Nature's efforts to obliterate the diseased artery by the accumulation of fibrin within the sac; and for this, repose, by interruption of the circulating current, is essential. And it is especially interesting to notice how this observation has still guided the experimental surgery of Hunter's successors in perfecting his method of cure. Mr. Travers tried to arrest the blood-current by temporary ligature, but failed, and for many years no advance was made on the permanent ligature; but more recently the desired result has been obtained by tourniquet or digital pressure, or by forcible and sustained flexion of a joint where the position of the aneurism permitted it.

The most successful management of the accessible conse-

¹ Mr. Hilton.

quences of inflammation, such as come under the surgeon's care, is the most simple, that which may be termed the most natural—such as cleanliness, repose, moderation of temperature, and protection of a surface exposed by loss of texture. In the treatment of incised wounds, whether by accident or surgical handiwork, a careful study of Nature's ways, aided by the light of pathology, seems to me more trustworthy than the conclusions drawn from hypothetical propositions and the artificial systems based thereon, which have been credited with so large a share in the cure of wounds.

I apprehend there can be little doubt that the same essential condition is required for the healing of a wound, whether by adhesion or by granulation; and this condition is the presence of a layer of coagulated fibrin on the surface. A derivation from the extremities of the capillary vessels in either case, this temporary pellicle is the cradle of the new offshoots; and having fulfilled this office it disappears. If we watch a freshly cut surface, and cleanse it from accumulating coagulum, we observe that the exuding blood is gradually deprived of its red particles, until finally pure serum flows, from which the coagulable fibrin is deposited. Such is the pathological teaching; and how are we to apply it? In waiting patiently till the time has arrived for favouring this coagulation by sponging the surface (say) with spirit or a solution of chloride of zinc. Subsequent adaptation of the cut edges, free exposure of the wound without dressing of any kind, and scrupulous cleanliness, combined with abstinence from all meddlesome interference, constitute, in my opinion, after a lengthened experience of this treatment, the best security for speedy healing, and against any external source of contamination.

Guided by the same wholesome trust in Nature's ways, I have for many years relinquished the use of free incision in carbuncle; being satisfied that, with rare exceptions, this tempting practice is not simply useless, but that it mischievously checks an eliminative action, and is actually fraught with serious risk in many instances.

The excision of diseased joints—an innovation on the mutilating practice of amputation, in which this country has taken such a leading and active part under the guidance of two

other ex-Presidents of our College¹—may be regarded likewise as a triumph we owe to the same careful observation of Nature's ways. A joint is destroyed by inflammation, perhaps itself the consequence of some irremediable lesion ; and all Nature's resources are engaged in the effort to be quit of its disorganised and now useless constituents. How simple and how natural does it now appear, to second these efforts by laying open the spoiled joint and removing the diseased textures, and thus to afford an opportunity for repair, by the utilisation of those very means which were previously wasted in fruitless and therefore exhausting activity. We owe skin-grafting to the same watchful attention to the way in which the smallest germinal islet, left by ulceration, will spread to meet and draw towards it, by some occult attraction, the nearest border of the surrounding integument. Even lithotomy is a more natural mode of removing a stone from the bladder than its extraction through an artificial opening ; and the comparative success of this operation, with diminished risk, must act as a discouragement to future attempts to discover a solvent. Yet, in such experiments, instituted for the relief of suffering, and subject to an acquaintance with the laws which govern the animal economy in health and disease, empiricism has its justification. We now excise a cancer as we extract a stone, because it is a method which, though an avowal of our ignorance of its true pathology and of our helplessness in arresting it, offers the best known prospect of relief. But I feel persuaded that the antidote to this malignant disease must be sought in therapeutics and hygienic measures ; and may we not even hope that the discovery of the source of this perverted nutrition, in the disturbed function of an unsuspected organ, may some day place the arrest of this malady within our reach ? The knife is the most effectual *local* remedy ; but its imperfection is demonstrated by the reproduction of the disease and its extension through the lymphatics. Yet this circumstance is not without its suggestive value ; for it indicates to us that, by a further insight into the physiology of nutrition, we may expect to become acquainted with the exact pathology of this mysterious malady, and that it is through the channel of the absorbents

¹ Sir William Fergusson and Mr. Hancock.

that we may hope to meet and combat the dread enemy, for which our art is not a match, and which still defies our science.

I venture, Sir, to claim for John Hunter a large share of merit in contributing to the adoption of these more enlightened principles in the treatment of disease, which I have attempted to illustrate,—principles springing from a more intimate study of, and a more loyal dependence on, the resources of Nature.

Comprehensiveness was another remarkable feature of this great man's work ; and one which, happily for scientific surgery, still distinguishes its most successful cultivators. He was not comprehensive in the sense in which his great prototype Aristotle was so ; for the Stagyrte's grasp of intellect and reach of thought extended beyond the domain of the natural sciences : but they were alike sagacious in observing, and assiduous in collecting, facts and in classifying them. It seems natural to associate these two names, though so widely separated in time, when speaking of careful and extended research in the structure and functions of animals ; and whilst we are equally impressed in each with the quality of which I am speaking, we may give Hunter the palm for independence of thought, and for freedom from those scholastic trammels, which the antecedent training and educational associations of Aristotle almost necessarily entailed. The capacity for deep reflection, in a truth-seeking, impartial spirit, conferred upon Hunter a singular power of combining his accumulated store of facts in a comprehensive and intelligible classification, which was of more value to him than metaphysical learning, and in great measure compensated for his lack of logical discipline.

There is yet one other characteristic exemplified in all that Hunter *did*, which merits special notice as essential to—I may say the very backbone of—all useful scientific research : I mean *Accuracy*. There is truth in a forcible expression of opinion which I met with in an Address to Science and Art Students by Sir Arthur Helps, who is reported to have remarked that he believed “all the intentional lying in the world—of which there was a good quantity, perhaps—did not do one quarter of the mischief that inaccuracy did.” And certainly it has done more to fetter scientific progress than

wilful misrepresentation, because usually more insidious and difficult of detection, and on account of the many absurd and mischievous fallacies which are thus generated and perpetuated.

In speaking of accuracy as characterising all that Hunter *did*, I mean that he was scrupulously accurate in his facts derived from actual observation ; but we find, in his writings, examples of a form of inaccuracy that is probably due in a measure to defective training, but is also evidence of an amount of self-reliance which induced him to treat, sometimes with unmerited indifference, the opinions and researches of others. This is exemplified in his zealous support of his own opinions on vitality, where he confuses fermentation with decomposition, giving a very dogmatic, though even for his time incorrect, definition of the former word ; and then adds, in a deprecating tone, that “the processes carried on by chemistry and fermentation, which can *only* take place when the parts are dead, have been introduced by physiologists into the living animal economy ; and, not satisfied with this, they have brought in mechanics to account for many of the operations of vegetables and animals.” It is with some little inconsistency, though not altogether irrelevantly, that we find him, in the course of this discussion, exclaiming with bitterness, mingled probably with perplexity—“Of all things on the face of the earth, definitions are the most cursed ; for if you make a definition, you may bring together under it a thousand things that have not the least connection with it.” Now, this stricture on definitions is quite admissible where they are loose and inaccurate, but otherwise most inappropriate in its general application, and especially so in relation to scientific inquiries. It may be reasonably expected that the more general cultivation of accuracy in all pursuits will be one of the fruits—perhaps the most precious—of the at length awakened recognition, in our schools and universities, of the value of natural or physical science in the training of youth, and as an important element of general education.

In the foregoing remarks, exemplifying the influence exercised by Hunter’s suggestive work on our branch of the profession, I have selected a few of the fruits gathered in by modern surgery ; yet far more remains, which, with equal

propriety, would illustrate my argument : and if we turn from the cure of disease to pathology, and its sister science physiology, how extensive is the field which opens before us ! In Hunter's time but little was known with exactness, either as regards the functions, the minute structure, or the morbid changes in organs or tissues ; but organic chemistry, the microscope, and carefully conducted experiments, have placed within our reach a vast amount of ascertained facts, to which, I fear we must admit, our therapeutic mastery over disease bears but a modest proportion. Indeed, it is since Hunter exemplified the close alliance between these sister sciences and their true relation to practical medicine, that some of our most distinguished surgeons have gained their legitimate laurels by their joint cultivation. And of such I cannot cite a more conspicuous illustration than is afforded by the teaching and published writings of our senior Vice-President.¹

I have said that the practical fruits of these researches are not commensurate with the progress which these sciences have made since Hunter's time. But the impulse has been given, and the conviction is deeply rooted that to Physiology we must look, as the chief means of rescuing Medicine from the charge of empiricism, and of transforming an experimental into an inductive science. It is the Physiology of Life—a patient study of the various phenomena which constitute and accompany vitality—which must accomplish this change ; and already we have strongly marked indications that it is from the mutual and comprehensive relations of the nervous and vascular systems, and their influence on the various and complex stages of assimilation, that we may expect revelations which shall guide us in the prevention of disease and in its successful treatment. What more apt illustration of this belief can I adduce than the demonstrated agency of the vaso-motor nerves ? Much of the vague sympathy with which the cyclo-ganglionic centres were formerly credited, and on which Hunter dwelt so much, is now shown to be due to their direct influence on the muscular coat of the arteries—an influence and supervision which is so constant and conservative, that it is by its occasional suspension in organs, which are intermittent in their activity, that a suffi-

¹ Sir James Paget.

cient supply of blood is admitted for the due performance of their functions ; and thus we have a reliable explanation afforded of a fact—already recognised in Hunter's time—that the healthy vascular activity of an organ is dependent on its appropriate stimulus. The knowledge thus gained has already been prolific of good in many branches of pathology, and we look hopefully for the practical lessons in the treatment of disease to be acquired from so important a discovery. Yet, how recent was the first demonstration of the muscularity of arteries, although this property was assumed and loosely spoken of by Hunter,—so recent that when the generation to which I belong began their studies it was rejected by the ablest physiologist of his time.¹

If the physiology of the present day presents a striking contrast to that of Hunter's era, the progress which the physics and chemistry of life have made is no less remarkable. Little was then known of the true nature of, and various changes in, the living fluids ; of secretion and absorption ; of the elements which are essential or prejudicial to health ; of the source of heat. Yet how momentous have the discoveries in these directions become to the physician ; and how important must the study of the perverted or arrested chemistry of the living frame prove in the treatment of disease. The attention which has been bestowed upon the varying temperature of the body has already been found of incalculable value in diagnosis. May not similar observations in relation to its electric condition be no less significant in the same direction, and even applicable therapeutically in surgery as well as medicine, when we possess available means of testing and employing it ?

Yet, with so much in our favour, the prejudices and the obstacles to the diffusion of practical knowledge which Hunter had to combat are not yet extinct ; and I fear that our teaching is not entirely blameless in this matter. Perhaps I should rather say, the way in which our students learn their profession ; for I freely and thankfully admit the beneficial change which has been wrought of late years in the character of our teaching generally, and in the moral tone and preliminary education of our students. Yet our system of in-

¹ Professor Müller.

struction is not perfect—indeed, it may be questioned whether our efforts to make it so have not overreached their mark, in the invention of facilities for learning, and to the prejudice of the student's best interests in after life. It seems as if the hurried, the competitive life we are now leading were uncongenial to reflection. Be that as it may, it is impossible for those, whose duty it is to test the attainments of our students, to ignore the fact that knowledge is acquired too often without reflection; that even the more intelligent are sometimes satisfied to store their minds with facts, without reasoning or seeking for an explanation of them. I am jealous of the artistic illustrations which are scattered broadcast through our anatomical and surgical text-books, for I fear that their abuse too often lures the student into the fatal error of believing that he can thus acquire that which should be learned only in the dissecting-room and by the bedside. What would John Hunter, whose life was spent in intercourse with Nature, have said to this? Our prepared College dissections are copied to facilitate their recognition,—our selected museum specimens are studied that they may be identified,—our written questions are stored for the instruction of future candidates for our diploma, as if this were the “Ultima Thule” of their aspirations or responsibilities. Suggestive writing, personal dissection, and even clinical teaching have not the popularity which is accorded to exhaustive or dictatorial instruction; because the latter saves the learner the trouble of reflecting on what he is taught, of seeking for a meaning in what he witnesses, of pondering on the relation between cause and effect.

Possibly, the time allowed for study is not commensurate with the extent and variety of the information now required of candidates for a medical degree,—possibly, the student prefers that method of learning which costs him the smallest expenditure of time and energy, and yields the readiest return in his success at his examinations. Whatever the explanation may be, the result too often is a quickened memory, but an otherwise undisciplined intellect; and, as a natural sequence, where such is the case, in the responsibilities of practice the frail reed of precedent is leaned upon, because the sustaining resource of sound principles has never been

properly appreciated,—for the learner has not cultivated the habit of thinking for himself.

In making this observation let me pause for a moment, whilst I direct your attention to the well-known and truthful portrait before you,¹ and ask—Was meditation a trouble to him it represents?

Whilst we gaze on that face there is no difficulty in crediting the exclamation attributed to Hunter, “It is a pleasure to me to think!” I venture to commend this sentiment, and its realised expression in feature, to my younger hearers. The habit of sustained, unwandering thought may be acquired; and the neglect or cultivation of this mental discipline goes far in explaining the contrast between the faulty *instruction* of the many, and the fruitful *education* of the few.

The most hopeful remedy for these hindrances to progress at which I have glanced, is to stimulate in our students a more general taste for converse with Nature; to foster the habit of thoughtful inquiry; and, I may add, to encourage a healthy recognition of the moral aspect of science, as devotion to truth for its own sake, as well as for its practical utility in its social and professional aspects,—desiderata which, I venture to affirm, have been studiously kept in view, in their endeavour to realise the aspirations of John Hunter, by the Council of this College.

Vitality and development engaged a large share of Hunter’s attention, and were then regarded as strictly within the domain of physiology: but in these latter days force and matter have been credited, by physicists and biologists, with more varied powers than were ascribed to them in his time; and the revival of speculations, respecting the association of these powers with life and evolution, involves questions of more momentous interest than he contemplated, by again raising an alarm lest natural and revealed truth should be thereby placed in antagonism. But when we speak of endowments and natural laws, these expressions, if any definite meaning is to be attached to them, are but convertible terms for the gifts and will of God; and, if our knowledge of these were more comprehensive, and our capacity to understand all their relations were enlarged, we should probably see no

¹ Portrait of John Hunter by Sir Joshua Reynolds.

incongruity in such deviations from what we *assume* to be their uniformity as are implied by special supervision; and we should be able to reconcile many apparent inconsistencies, in that which addresses itself to our senses or our reason, and that which appeals to our faith.

Yet, whilst we witness man's varying interpretation of Nature's laws as the horizon of our knowledge widens, generalisation marches onward with equal tread, now rebuking the delusive timidity of some, and anon rewarding the patient research or bold forecast of others. It is true that, amid all this unceasing activity of mind and matter, this progressive movement onward and upward, change and decay are stamped on all we see around us. Yet these are but the precursor—nay, the necessary condition—of repair and renewal of life: a perpetuation based on dissolution, which is at once an emblem of instability and permanence; alike the foundation of the philosopher's confidence in the ever-recurring order of Nature, and a symbol of the Christian's hope, and of his faith in Nature's unchanging and unchangeable Author.

A few more words, Sir, touching personally the subject of this address, and I shall conclude.

John Hunter's character does not seem to me a difficult one to understand, for we have the record of his everyday life—the most trustworthy exponent of principle—to guide us in our estimate of the motives by which he was actuated and the means by which he achieved such great results. His intellect was essentially masculine and vigorous; and his untiring energy and unswerving devotion to his work, even in its minutest details, carried him forward, where others would have been daunted or repelled by the mere contemplation of the comprehensive plan he designed, and the stupendous labour it entailed. Self-reliance is an essential attribute of such a character; and probably this was in some degree fostered, in Hunter, by the lack of those refinements which early education imparts; for he could not but be conscious of his own superiority—indeed he did not always refrain from asserting it—in his intercourse with others who were more favoured in this respect. Yet I cannot persuade myself that he did not really and deeply regret the wasted time and unemployed

talents, which marked his career till manhood overtook him. We can scarcely wonder that, at this late period, he should have rejected the advice of his brother, to redeem his lost time and supplement this defect, by doing the work of boyhood at the age of twenty. But this decision simply shows his awakened consciousness of the value of time ; and he well knew that his higher aspirations then would have unfitted him for the drudgery of general and elementary education. Moreover, in Hunter's time, and for his particular pursuits, preliminary gymnastics for such a natural athlete were less needed than at present. The sciences he cultivated were in their infancy ; a literature of comparative anatomy and of comparative physiology scarcely had an existence ; and foreign books were little read or heeded. He planned his own work, and resolutely carried out his own design.

Hunter owed no share of his professional success to that most profitable of social qualities—tact ; and seemed not even to appreciate the advantage of refinement ; for he did not care to control the natural impetuosity of his temper and the bluntness of his manners, which must have often given pain to more sensitive minds : but he did not affect rude and uncourteous behaviour, in the erroneous belief that such conduct is necessarily allied with originality and genius. Happily, these deficiencies were not considered serious obstacles to his qualifying himself as a surgeon, though they were regarded by his polished brother as a bar to his success in practice as a physician : yet Surgery had already asserted its independent dignity in this country, and was then represented by Cheselden at St. Thomas's, and by Pott at St. Bartholomew's—both educated gentlemen as well as accomplished surgeons.

Although not free from the foibles of a strong character, his warm affections, his keen sense of justice, and the promptings of a noble nature generally guided him aright, and saved him from unworthily resenting many provocations.

I have sometimes pondered over John Hunter's title to be called a man of genius ; and this has led me to ponder further on what the word "genius" means. Ill defined and differently interpreted, this epithet is often employed to express some vague idea of originality, involving the fallacious supposition that any mind, however gifted, can create with-

out receiving. The richest soil is barren until the seed is scattered, and warmth and moisture are imbibed to fertilise it. The spring, which rises in bubbling freshness from the earth's surface, is fed by the rain which the clouds supply. So it is with man's intellect; so alike with the naturalist and poet; they must open their hearts wide to Nature, and patiently await her teaching, instead of restlessly forestalling her response. But if genius means this craving aptitude for conversing with Nature, conjoined with consciousness of power and self-reliance, a strong will with singleness of purpose, a healthy balance maintained between acute perceptive and profound reflective faculties, and perhaps beyond all "a transcendent capacity of taking trouble,"¹ then truly may the possession of this comprehensive talent be assigned to one, whose life so remarkably exemplified the exercise of such a rare combination of qualities.

"He was indefatigable with the indefatigability which has been called one of the truest signs of genius."² Such are the words which were spoken, with equal propriety, over the mortal remains of an eminent divine, whose sudden death was a shock that vibrated through the length and breadth of our land; and in this characteristic, evinced and exercised in such different spheres of labour, and with tendencies and acquired tastes in which there were so few other points of contact, there was a near resemblance between John Hunter and Samuel Wilberforce. And in the close of their long day of toil they were alike, for "when the night came upon them, it was as with the sun of the tropics—there was no twilight." The interest taken by our late trustee in our Museum, and his frequent presence on these commemorative occasions, will justify this passing tribute to the memory of one whose character endeared him to all who knew him, and of whom, as an accomplished Christian gentleman, we, as Englishmen, are justly proud.

John Hunter worked alone. He was sensible of his own resources, and treated with their merited contempt the neglect and jealousy of smaller men; but he escaped the penalty of disappointment, for he had no preconceived notions or

¹ Carlyle's 'Frederick the Great.'

² Dean Stanley's Sermon on Bishop Wilberforce.

hypothetical novelties to prove and support, by the perversion of facts to the particular bent of his inquiries. Much that he accomplished was exhaustive, still more suggestive, but all was trustworthy, and freely given, without a thought of self-exaltation, to posterity; and thence the ever-increasing appreciation, the stability of his fame. And should it not be so? The starry firmament, the aged hills, the perpetual streams, are emblems of constancy and permanence; and shall not honest fame endure as long as they?

“Great deeds cannot die;

They, with the sun and moon, renew their light

For ever, blessing those that look on them.”¹

As distance alone imparts its true perspective to the loftiest Alpine summit, which towers in solitary grandeur far above ridge and glacier and icy peak, so as time advances and we recede from Hunter and his contemporaries, we see him standing forth in all his colossal proportions. Yet this greatness was due chiefly to the exercise of faculties and attributes which are not peculiar to him, except in their remarkable combination and unremitting employment. And herein, to my apprehension, Hunter differs from many who are, with equal justness, ranked amongst the brightest ornaments of our country; and herein, also, is his example fraught with so much of value and encouragement to all students and lovers of Nature. His simple life and unpretending tastes, his earnestness of purpose and single-hearted devotion to his work, are characteristics which all may imitate; and, though it be given to few to approach his excellence, none can follow in his track without in some degree fulfilling the purpose of his existence in his temporal and social relations.

But pre-eminently was John Hunter's life imbued and characterised by a love of truth. It was the “mystic altar” before which he ever knelt, the energising impulse which determined and regulated his every aim and purpose, the guiding star of his existence; and it is also the most precious legacy he has left to us, who delight to honour him or desire to emulate his virtues, and to tread, however humbly, in the footprints of his fame.

¹ Tennyson.

UNITY OF TYPE AND SIMPLICITY OF STRUCTURE

AS ASSOCIATED WITH

COMPLEXITY OF FUNCTION IN THE ANIMAL ECONOMY.¹

MR. PRESIDENT, MR. TREASURER, and GENTLEMEN,

It is with unassumed diffidence that I approach the task I have undertaken, at the request of my colleagues, on the present occasion.

The assiduous cultivator of the higher branches of any particular science is rewarded by the gratifying ability to communicate his discoveries to an expectant audience: nay, the day-labourer in the same wide field may perchance turn up his heap of gold, and make the most of it, before the hundred eager hands are stretched forth to grasp the treasure as their own. But I have no pretensions to the good fortune of the one, nor to the privileged claims of the other.

To provide a suitable subject for an occasion like the present is, in itself, a difficulty, even for one gifted with the power of treating whatever he may select in a popular and agreeable way. Some of my audience are, I am well aware, acquainted with all I have to tell them: yet, though the

¹ This address was delivered in the Board Room of old St. Thomas's Hospital in January, 1852, before a mixed audience of the governors, medical officers, lecturers, and students; and being printed from the MS. of that date (a request that it might be then printed having been declined), the reader will have the opportunity of comparing some points in the physiology of the present day with the opinions which were prevalent nearly forty years ago. The references to illustrative experiments, preparations and diagrams, are omitted.

facts I shall adduce may fail to instruct, I am not without hope that, in a collected form they may assume a more striking interest than they possess, when scattered through the pages of the book of life from which they have been gathered. To my younger hearers I do not apologise for any repetitions which they may recognise as amongst the means I have employed, in our almost daily intercourse, in feebly leading them to look upward from nature to nature's God. Nor am I unmindful that I am addressing a third class ; and I shall be amply repaid if they, the uninitiated in our noble Profession, should glean from my address some trifling information, some subjects for serious and improving thought, a germ of knowledge which may spring up and ripen in the kindly soil which shall receive and cherish it.

In the advance of science, as nature's stores have been unfolded to the patient and humble inquirer, confusion and complexity have gradually given way to order and simplicity ; inductive philosophy has enabled us to generalise, and thus to refer the wondrous phenomena within and around us to few and simple laws :—destined probably to be still fewer and still simpler before we reach the boundary of human knowledge. Thus it is that the mystic scepticism of early ignorance has been swept away, and that we have been drawn, step by step, closer to the Framer of those simple laws. And, as we stand nearer to the summit of that lofty hill up which our forefathers have climbed with toilsome tread, the widened range of our ken serves, or should serve, but to humble us with an increased sense of our own personal insignificance ; and by affording us a feeble glimpse of the boundless expanse around us, to humble our pride, and to teach us that essential element of all true knowledge,—a consciousness of our own straitened capacity and ignorance.

But, though the fundamental laws by which it has pleased the Creator to work are thus few and simple, multiplicity of appliances in many of the instruments, employed to carry out the details of these laws, is no less a recognised principle in nature. It is a part of that economy of means to a given end which is so strikingly characteristic of natural operations ; and which has been feebly imitated by man in the production of his most perfect machinery. And I may here

remark that we look in vain for real anomalies or contradictions in nature ; all is subservient to the laws which regulate the mighty fabric as a whole ; and no miracle is worked to reconcile that which, to our feeble efforts in construction, would be irreconcilable : but power is exhibited in reducing to submission the elements of opposing force and action, and in making them work together in harmonious simplicity.

Yet, let me not be misunderstood, as intending to imply that there is any abstract necessity in the consequences of these laws. I recognise no such thing as absolute physical necessity : all is conditional ; and the condition is, the uniformity of the laws which regulate their consequences. The absurdity of attempting to reverse a mathematical axiom, to bound an enclosed space by two straight lines, or to make the combination of any given numbers result in other than one product, is palpable enough ; here indeed an irreversible necessity exists : but not so in physics ; for He who framed the law may suspend it.

And this is an important distinction to bear in mind in the study of phenomena which are referable to natural laws ; and serves to give us a clearer and more intelligible view of the operation of the latter in the production of the former ; whilst we can scarcely fail to see the finger of science ever pointing upward to the great First Cause of all.

It has been charged upon the doctrine of final causes, or, as it has been denominated, the principle of the conditions of Existence, that a strict adherence to it excludes an acceptance of the law of typical development, as seen in so many parts of organised creation. But this charge is unfounded and unjust. There is no such inconsistency. The axiom in morals is equally just as applied to Physics, that truth is One : and that genuine Unity must be based upon Truth, as these two principles are necessarily allied as joint attributes of the God of Nature. Moreover, by recognising the association of special adaptations to their appropriate ends, with Unity of design, an additional charm is imparted to the study. Indeed, unless the latter principle be conceded, the former loses much of its value and interest ; inasmuch as special adaptations—whether in various parts of the same organism, or in different genera and species of organised

beings—constitute so many necessary deviations from that uniformity of development, which is otherwise observed so extensively through nature.

I have said that functional complexity characterises natural agents ; in other words, that many and varied ends are accomplished by one and the same instrument. Wherever we look abroad in the wide expanse of nature's vast resources, the same obvious truth is illustrated. Take, as an example, the sun, that brilliant orb around which our own planet rolls. By its influence the ethereal wave is originated ; which, undulating through the hundred millions of miles in space it has to traverse, at last impinges on the delicate nervous film created and designed for its special appreciation ; and then it breaks, sparkling, on its destined shore ; and this is the light of day. The warmth which vivifies and animates all organised creation, which calls forth the soaring lark's cheerful matin song, to which the sunflower turns in silent adoration, whilst many a little bud weeps, with closing eye and drooping head, when it is withdrawn ; the mighty and mysterious influence which keeps our globe, ever whirling onwards, yet bound by the adamant chain of gravitation in its fixed and unerring orbit ; the phenomena of day and night, the alternation of the seasons ; these are some of the more striking and varied purposes which are fulfilled by this glorious luminary. Take, as another example, the air we breathe. Life, both animal and vegetable, are dependent on it ; by it combustion is supported, sound conveyed, and scent diffused ; and thus it ministers to our sensuous gratification and comfort, whilst it is no less necessary to our very existence. In motion it is the gentle breeze, which, softly playing, fans the fevered cheek ; or, anon it becomes the viewless, wandering winds, big with destruction ; which

“Hastening on in their boundless flight,
Over the mountains and over the deep,
Their broad invisible pinions sweep,
Like the spirit of liberty, wild and free.”

But time would fail me to follow out the varied uses of this invisible agent, and of the many others which present themselves as illustrating the same truth. In short, multiplicity

of appliances combined with simplicity or unity of means, as much characterise the products of nature's laboratory, as the converse stamps the contrivances of man: the one finite, feeble, and soon wearisome; the other ever increasingly attractive, perfect, infinite.

It is not by simply gazing at Nature's works that we recognise their functional complexity and perfection: they must be looked into and examined. It is with this view that I have selected my present subject: and in confining myself to the human organism, so abundant are the materials for illustration at my command, that I can only venture to cull one here and there in each system which composes our frame; and therewith exemplify the economical principle which associates multiplicity of uses with individual structures.

In comparing the composition of organic and inorganic bodies, we find that they contain similar elementary constituents; but that the former, or organised bodies, both animal and vegetable, are much simpler in their constitution, as regards the number of these elements, than unorganised bodies: of the 52 elementary bodies into which the chemist is able to resolve all substances which are included under the latter head, only 18 at most are found to enter into the composition of the organic kingdom. But, even of this small proportion, the greater number, consisting principally of the metals, are only incidental elements: the three gases, oxygen, hydrogen and nitrogen, with carbon, constituting the essential components, and by far the greatest bulk of all organic matter. The mind that becomes acquainted with this fact for the first time, must indeed be insensible, if not struck with the simplicity of the means employed for such varied, such multifarious ends; and which does not recognise in the diversity of purpose, combined with the wonderful unity of plan, an incontrovertible evidence that the whole was devised by one mind, infinite in wisdom, unlimited in resource. But, to proceed. Uniformity of structure characterises the lowest organised creatures: as we ascend to the higher classes, we find an increasing variety of texture, which is itself a measure of progressive organisation, and is accompanied by correspond-

ing complexity of function. Yet, the more highly endowed animal attains its complicated organisation by passing through the same stages, in its earlier development, as the more simple: each is perfect in its kind, though varying in degree of complexity according to its destiny and sphere of action.

The principle of Unity is remarkably exemplified in this fact; that all vegetable and animal structures, in short all matter endowed with life, with a few exceptions, springs from one typical form,—that of the nucleated cell. The dynamic part of the brain of man, equally with the lowest fungus, possesses these nucleated cells. This, then, appears to be the primary form which organic matter takes, when it passes from the condition of a proximate principle, to that of an organised structure; and all the varied textures of the perfect adult being, endowed as they are with a wonderful multiplicity of functions, may be traced in their origin to this simple cell.

The same simplicity and uniformity of means, the same unity of design, may be noticed in the various component textures of the body. In the Osseous System the archetype vertebra is the fundamental form and basis of the skeleton of all vertebrate animals, whether fishes, reptiles, birds or mammals. In the Muscular System of different animals, however varied may be the appearance of Muscles, pale, dark brown, red, coarse or fine, yet the real instrument, or typical muscle, the ultimate fibre, is essentially the same in all, from the creeping insect up to man. In the whole class of epidermic appendages, whether they be hairs, bristles, nails, hoofs or claws, all are formed on one and the same plan. In the organ of hearing, the essential part of the modifying apparatus, the vestibular sac, affords the same common type, from the cuttle-fish to man, whatever the mode or extent of audition. All these examples, I say, illustrate the same pervading principle throughout the animal economy; and confirm the truth of my proposition, that unity and simplicity as to type and structure, are associated with multiplicity of appliances or secondary modifications, in the living organism. But it is time that I pass on to some more detailed illustrations of this inter-

esting law ; and I will first direct attention to the Osseous System.

Combined with special adaptation to particular ends, we meet, in the Skeleton, with an Unity of Design, and typical arrangement of detail which cannot fail to strike even the most superficial observer. And this, perhaps, is most remarkable in the limbs of animals, which are applied to so many and such varied purposes : whether it be the paddle of the seal, the wing of the bird, the climbing arm of the bear, the clinging limb of the misnamed sloth, the spade of the mole, or the fleet leg of the antelope :—whether it be for swimming, flying, creeping, walking, climbing, digging,—in all we have one and the same type, each perfect in itself, and in its adaptation to its special function ; but modified according to particular requirements.

The uses of Bone are various, but may be classified under three heads, viz : leverage, support, and protection. Some bones are simple levers, others are specially destined for protection. Such are, severally, the bones of the arm and head : others again, as in the lower extremity (for I now confine my special illustrations to the human organism) fulfil the double office of levers and supporting pillars. But in the whole range of human osteology, that part which has ever riveted my attention and excited my admiration beyond all others is the vertebral column. The multifarious and apparently irreconcilable uses it has to fulfil, the comparative simplicity of its arrangement, and the unity of its design, consisting as it does of a repetition of the same essential elements, with but little variety in form or size ; all this cannot fail to produce a vivid impression on those who examine, even cursorily, this beautifully perfect, this simple yet elaborate piece of mechanism.

I have said that the functions of the spine are various : and it is truly so ; for in it we have co-existing the required properties and uses of all other parts of the skeleton. It is a column through which the superincumbent weight is transmitted from the head to the pelvis, and thence distributed to the lower extremities. It is a long lever acted upon by powerful muscles, and admitting thus of being swayed backwards and forwards, or from side to side : and yet, withal, it

is taxed with the transmission of a vital organ, the delicate spinal cord ; the laceration, nay the mere rough pressure of which, (as we know by sad experience within the walls of this Institution,) is almost certain death. Such are the complicated requirements of this column ; and how are they fulfilled ? By the simple repetition of a series of bones, 24 in number, knit together by a tough elastic substance, and fitted with joints which are, as it were, dove-tailed in together, so as to obviate the risk of displacement. But wherefore so many parts ; why not an uninterrupted column like the thigh-bone ? Because hereby the risk of injury from external violence is infinitely lessened, at the same time that the graceful, easy flexion of this powerful lever is permitted. Yet these bones are not symmetrical in size, but gradually increase in bulk as we descend from the apex to the base of this lengthened pyramid. There again an obvious purpose is answered. The superincumbent weight gradually accumulates by the addition of arms and trunk to the head which surmounts, statue-like, the summit : and, moreover, the leverage is progressively augmented, until it attains, from the length of the moving column, and the immense power of the motor muscles, an amount threatening self-destruction. Yet this is all compensated for by the closer locking in of the articulating processes with each other, and by the increased solidity and massiveness of the vertebræ in the lumbar region.

But, wherefore, some of my readers may ask, wherefore the undulating curves of this column ? We have here also a simple contrivance designed to fulfil palpable and important ends. The large receding dorsal curve extends the capacity of the thoracic cavity, and thus makes more room for the heart and lungs contained within it. But both this, and the smaller compensating curves in the lumbar and cervical regions subserve conjointly a still more important purpose : one without which, it is not too much to say, all the other special adaptations and perfect mechanism would exist in vain. Each time the foot is planted on the ground, we experience, albeit unconsciously, the influence of this simple arrangement ; the absence of which would entail a succession of concussions, by contre-coup, of the presiding nervous centre

contained within the skull. What then would be the effect of running or leaping if the spine were a straight and rigid column? Little short, I apprehend, of those frequently fatal injuries we meet with as the consequence of perpendicular falls on the vertex; of which paralysing commotion of the brain, or extended fracture of the base of the skull is the common sequence, from the accumulated weight of the falling body being concentrated, unbroken, around the central aperture by which the spinal cord is prolonged into the canal appropriated to it. The foregoing is but a rapid and imperfect sketch of this simple but wondrous mechanism and its complicated functions.

Muscle,¹ from which I draw my next illustrations, constitutes one of the elementary tissues of the body; it exists in vast abundance, and is moulded into every variety of shape and size, to adapt it to the multifarious uses to which it is applied. I have already cursorily alluded to the Unity of Type which characterises the ultimate fibril of muscle in all classes of animals, from the insect up to man. This ultimate fibre does not, however, present the same microscopic appearance in all muscles: some, especially those under the influence of the will, and the fibres of the heart, are distinguished by a cross-striped appearance; whereas others want this striped character, and appear as simple flattened bands of a paler hue: the involuntary muscles are included in this latter category. I shall not fatigue you by further dwelling on the microscopic branch of the subject: as it is still a subject of controversy what is actually the elementary nature of these fibrillæ; for so great is the optical deception in viewing transparent textures, under a high power, by transmitted light, that even practised observers have arrived at very different conclusions.

The variety in shape, and range in size, of muscles is very great. In the human ear there is a muscle not more than two lines long; whilst in the thigh of man is one exceeding two feet in length. Some are accumulated into

¹ The illustrations derived from the "Joints" have been omitted here, as they are, for the most part, included in an article on that subject, at p. 152 of this volume.

masses, others expanded over large surfaces : some are solid, others hollow ; some are square, others triangular, rhomboid, trapezoid, orbicular or annular : but these forms are merely secondary modifications, adapting the muscles to their special uses. The peculiar property which muscular fibre is endowed with is active contractility ; the stimulus to contraction varying according to circumstances. Volition is conveyed through the medium of conducting nerves : but other impressions from without, both mechanical and chemical, likewise act as stimulants to muscular contraction. The ultimate fibrillæ of which I have spoken are bound together by areolar tissue, and the resulting fascicles are collected into coarser bundles. They are supplied, like other highly organised textures, by abundance of vessels and nerves. Such is the unity of type and simple structure of this largely diffused component of the animal frame : and now let me briefly enumerate some of the varied purposes to which it is applied.

There is scarcely a single function in the living organism of which it can be said that it is strictly independent of muscular action. The simple contractile tube which represents the heart in early embryonic life, commences then its ceaseless rhythmic action, and proclaims the presence and influence of this pervading power. Under its imperative sway we are forced headlong into the world ; and our first act on entering on our new career is the muscular gasp by which we inhale the breath of life ; and that act is repeated without suspension, be it for but one hour or for 100 years, until the close of our earthly existence. By muscular contraction the blood is pumped, with the same untiring energy, throughout the arterial system. Without it the food could not be masticated, neither could deglutition be accomplished. By the peristaltic wave digestion is aided and the intestinal contents are gently carried onwards to their destination. Without the aid of muscles, sight, hearing, smell, taste and touch would be but passive senses and almost useless. By muscular contraction we stand, we walk ; and we perform the innumerable acts for which the hand of man alone is adapted, whether it be in wielding the sledge-hammer, or in the delicate surgical manipulation, where the life of a fellow-creature

hangs, humanly speaking, on the steady and tempered touch of the operator. Last in the order of this brief enumeration, though not least in importance of the functions of muscle, is the use (I fear I must add the abuse) of the small but active member by which we hold communion orally with each other, and by the aid of which I am now addressing you. Truly wonderful is the mechanism of speech; and tempting indeed is the consideration of the varied functions performed by that small but exquisitely endowed organ, the tongue. The seat of taste, a busy agent in the comminution of food, essential to its deglutition; and unceasingly active in articulation, this restless little member serves also as the dial-plate of the complex works within; on which the index-finger of disease points with unerring certainty for him, who has learnt to read aright the changing figures on its face.

The physical properties of muscle in a living state differ remarkably from those presented by the same texture after death; its tenacity especially illustrates the influence of vitality on the animal organism. In all muscles, even those distinguished as voluntary, there is a constant tonicity, which is a very important property in preserving the equilibrium of muscular antagonism, and in maintaining the integrity of joints. These facts are illustrated by disease or accident. Paralysis of the extensor mass of muscles in the forearm, for instance, resulting from either of these causes, entails as a necessary consequence the close flexion of the fingers: and spontaneous dislocation may ensue from the mere weight of the arm, when the muscles closely inserted around the joint are paralysed. One set of muscles employed for a special purpose are in a state of constant contraction, exceeding the tonicity of ordinary muscles; I mean the sphincters. These guardians of the outlets of the body are ever active, never wearied; though ready to play a more energetic part, when so called upon by the mandate of volition. In other muscles—the purely involuntary class—we find the action is uniform and vermicular. Thus the peristaltic wave is ever flowing onwards from the stomach to the lower bowel; and it is rarely reflected, save under distressing causes which endanger the

health and even life of the individual. Many a sick headache is, I believe, traceable to a peevish duodenum; which, first corrupting the usually faithful door-keeper of the pylorus, then treacherously takes advantage of the sleeping sentinel, and pours its bitter contents into the unoffending stomach.

And in the more serious cases of obstruction lower down, as in spoiled intestine from strangulation, we find the peristaltic wave beating, as it were, against an impassable barrier, and thence reflected in an ebbing tide upwards, till the distressing symptoms of stercoraceous vomiting usually ushers in a fatal issue.

The rhythmical action of the heart and respiratory muscles is another variety in the varied phase of muscular contraction. Unceasing likewise, and alike untired, waking or sleeping, in motion or at rest, these rhythmical movements are continued from the cradle to the grave. Does not this fact point to the undoubted truth that what we call muscular fatigue is merely exhaustion of voluntary nervous energy, which imperatively demands intervals of repose? I cannot omit to notice that wondrous climax of *periodical* movements of which the uterus is the seat. Through nine long months its forces are accumulating: yielding submissively to distension; passive though powerful for mischief, it awaits its time: and then at last, when the months, the weeks, the days are completed, at the appointed time it rises in its might and expels its inmate, adding thus another to the world's independent existencies.

Lastly, I would speak of associated movements. How remarkable are these, though so familiar to us. In every act, whether it be that of standing, walking, or running, or in the apparently more complicated movements of the hand in its most difficult and rapidly executed manipulations, this association is present, and essential to the harmonious co-operation of the many agents engaged. And I may here notice a beautiful provision which exists for the preservation of a texture, which is endowed with such power as to be competent to effect its own destruction if not controlled. The muscles are so arranged in their relation to the skeleton and ligaments that no one can by any possi-

bility rupture an antagonist, provided that antagonist remains relaxed. But where this condition is not fulfilled, rupture of muscle may occur, as in the fearful contortions of the tetanic spasm.

These are some of the varied functions and properties of this widely diffused but simple and uniform agent. And is the active power of this texture innate, or is it derived from nervous energy? I once believed the latter; but more accurate observation and experiment have proved that the ultimate fibril, isolated entirely from all other textures, areolar, vascular or nervous, may be made to contract, under the influence of an appropriate stimulus. Finally, what is this contraction? whence does muscle derive this peculiar endowment? To the former of these queries I answer that the ultimate movements are molecular, but beyond the reach of sense: to the latter I reply, that it received its endowment from the hand that made it.

The heart and blood-vessels supply my next series of illustrations. In treating of a fluid the synonym of which is life; and of vessels which are as widely diffused as the blood they carry, no limited space would enable me to give even the most meagre account of all their varied functions. Suffice it to say that the blood, though not a homogeneous fluid, presents but trifling deviations in its physical characters, in allied classes of animals: and that the efferent and afferent conduits, with their intervening capillary network, constitute the simple type of the vascular system, through which the blood is pumped by the heart. Upon this vascular supply all organised structures rely, not only for their nourishment and growth, but for their very existence. And whether it be the stability of the osseous framework, the active power of the muscular system, the varied functions of the assimilating apparatus, or the presiding energy of the nervous centres; all are alike dependent on their vascular supply: and endowment, function, life itself, speedily become extinct when this vitalising fluid is withdrawn, or even too sparingly supplied, either for stimulation or secretion. And here I will quit this topic; to pass on to one which flows from it, viz. secretion; and I shall venture to detain you,

though but for a very brief period, whilst I say a few words about the glands.

The organs, which constitute this interesting and important part of the animal economy, may be divided into those which secrete an useful compound from the blood, and such as separate a purely noxious substance, to be cast off at once as not only useless, but poisonous to the system. It may be questioned whether any of the former class of secreting textures are simple in their function; that some are not we well know; and of this fact the hepatic secretion is an exemplification. The bile is essential to the perfect assimilation of the nutritious portion of the food; whereas it acts as a poison if not eliminated from the blood. Here then we have an instance of a compound function and an economical principle combined; both equally tending, positively on the one hand and negatively on the other, to the preservation of life.

Various parts of the animal frame present us with examples of a purely mechanical arrangement designed to subserve an important physiological end. Of this fact an illustration is exhibited in the structure of glands: however various the individual forms in which the secreting canals are arranged, whether tubular, convoluted, or ramified, they all agree in presenting a surface more or less extended, by which the same action is performed as is effected in a more simple manner by a plain secreting membrane. Extent of surface, packed into a small compass and convenient form, is palpably the object of the arrangement I refer to: and the varied means by which this object is attained constitutes the diversity which the anatomist observes in the intimate structure of different glands. Hence we learn the simplicity and unity of type in this widely spread and influential section of the animal economy: for, whether the secreting apparatus exist as shallow crypts or follicles, such as are met with on the mucous surface of the intestine and in the skin; or as canals of the ramified type, such as the mammary and salivary glands and liver; or again as convoluted canals of great length which maintain an uniform diameter throughout, such as the kidney;—I say, whatever may be the form of their elementary parts, all secreting

glands without exception (not only those of the human body, but all met with in the animal kingdom) follow the same law of conformation, and constitute an uninterrupted series from the simplest follicle to the most complex gland.

This uniformity of type is equally apparent in the *organisation* of glandular structures ; the diversity which is here observable being likewise due to the varying complexity of the mechanical arrangement referred to above. In all, I need scarcely observe, blood is required ; but the afferent vascular supply for secretion is not always arterial : in the liver, for obvious reasons, it is venous. Further, a tube is essential, as a conduit for the secretion to its destination. The simple follicle is its own tube : the pancreas, salivary glands and others have their ducts : whilst a third class possess, in addition, a reservoir, such as the liver and kidneys. Yet, even these appended sacs or bladders, are to be regarded rather in the light of dilated tubes, than as a superadded element in the structure of glands. But I feel I have said enough to establish my position regarding the unity of type, and simplicity in structure of glands ; though it must be admitted there is a complexity in the mechanical arrangement, in accordance with the requirements of each organ.

It can scarcely be needed that I should attempt an enumeration of the diversified functions of the secreting organs generally. A serous or synovial sac (each as it were, an expanded and closed crypt) is required for the mechanical perfection of the viscus, or joint with which it is associated. And a similar mechanical office is performed by the follicles of the mouth and tonsil glands. By the admixture of many secretions digestion is accomplished. To the secretion of others we owe our existence ; and also our support in tender infancy. By another set of glands the blood is freed from impurities, which if retained in it would speedily prove destructive of life.

Finally, I would notice, in passing, the analogy between the excreting glands and the lung. The elementary constitution of each is the same, viz. : an extended surface, a vascular network associated with it, and an arborescent excretory apparatus terminating in a single duct. The excretion, a noxious poison eliminated from the blood, which is

poured forth to be resolved into its component elements ; nitrogen gas being the vehicle which takes the place occupied by water in other secretions. I do not mean to say that the interchange of carbonic acid and oxygen in the lungs, (which is wholly in accordance with the physical laws regulating the absorption of gases,) is strictly an act of excretion ; but, admitting the analogy in other respects, how wonderfully complex are the functions of respiration. At once acting as the stimulant, by the circulation of oxygen, to all the organs of the body, and the source of animal heat, which is disengaged by the simple chemical combination of two elements in the systemic capillary network, this vital process is also economically applied to the production of *sound*. And what a world of new and varied thought here opens upon us ! Sound, which constitutes the human voice ; by which we not only hold communion with each other in ordinary converse, but by which the heart-stirring impressions of eloquence appeal to the sensorium and influence the soul of man. It is, indeed, wondrous that, in combining the various elements which are essential to the perfection of human speech, there should be so very little which can be said to belong *exclusively* to its mechanism ; for the existence of which, in fact, there is not a sufficient explanation, even without the power of speech. The respiratory act is clearly essential, *per se*, for the decarbonisation of the blood : the tube which constitutes the musical pipe, is the excretory duct : the vocal cords over which the air sweeps, Eolian-like, in its exit from the lung, and which vibrate to the frenzied shriek of pain and terror, or express the harsh howling of the coarser passions ; or, anon, give utterance to sounds which come in gentle cadence :

“ O’er the ear, like the sweet south,
That breathes upon a bank of violets,
Stealing, and giving odour.”

I say, these chords contributed to the protection of the air-tubes from the intrusion of foreign bodies, especially during the act of deglutition. If we extend our investigation further to the organs of articulation, the tongue, the teeth, the lips, their varied functions are too familiar to need more illustration, than has been already supplied, in

speaking incidentally of the sense of taste. I now turn to the concluding section of my illustrations.

In the *Nervous system* we recognise at once the seat of the sentient principle, and the originator of a power or force, which distributes its varied influence far and wide throughout the animal economy. The essential constituents of this system are nervous centres and internuncial cords; the latter having for their office to communicate between the former and the organs over which these nervous centres preside. It is through the instrumentality of this system that the mind of man influences his corporeal organs; and this constitutes volition: and again, centripetal impressions are conveyed along the internuncial cords from their peripheral extremities to these centres; it is thus the "Life of Relation," as it has been termed, has existence, by which the mind is enabled to hold communion with the world around. Such is the typical unity of this system (or rather set of systems, for there are many); and its simplicity suggests to the mind the analogous arrangement of the galvanic battery, and its wires of communication with distant objects, upon which the generated electric force is designed to act.

The nervous matter is soft and unctuous, and extremely delicate and fragile. It consists of, at least, three fourths of water, with some albumen and fat, and a small quantity of phosphorus, sulphur, and osmazone; these are the principal constituents of this wonderful organism: and is it not truly marvellous that such complex results should be achieved by such simple instruments? These elements are combined to form two structures, distinct in character and functions: the one of a reddish-grey colour, highly vascular, and constituted of vesicular nervous matter, which is granular in texture, and contains nucleated nerve-vesicles. This part is the originator of nervous force, and in the skull is more immediately associated with the mind: it has thence been denominated the dynamic portion of the encephalon: whereas the fibrous part of this mass, consisting of tubular and solid fibres, is simply the propagator of impressions made upon it. The internuncial cords or "nerves" consist of a bundle of nerve-fibres, surrounded and connected by that all-pervading texture, areolar tissue, which constitutes at once the uniting

medium between the fibrils, and the neurilemma or sheath of the nerve.

In addition to those nervous centres which occupy the interior of the skull and spinal canal, and which consist of an admixture of the two forms of nervous matter I have spoken of, viz.: the grey or dynamic portion, and the white fibrous or propagating part,—I say in addition to these centres, we have also a series of smaller generators of nerve influence, scattered principally throughout the interior of the trunk, and denominated ganglia. Other ganglia also exist in connection with the cerebro-spinal system, viz.: those associated with the fifth nerve, and with the posterior roots of the spinal nerves, of which the fifth is a type. A careful microscopical examination of the texture of one of these ganglia affords a correct idea of the minute structure of nervous centres in general. It exhibits a multitude of nerve-fibrils, interlacing with each other; and in the meshes thus formed, the nerve-vesicles, enveloped in their proper sheath, are lodged.

A mechanical arrangement for a special and obvious purpose, similar to that which I just now noticed as associated with glandular structures, is met with in the brain. I have remarked that the grey or dynamic portion of the encephalic mass is highly vascular; and its position, enveloping the fibrous matter, renders it more readily accessible, in the way I am about to describe. Besides the fibrous and serous investments of this delicate organ, a vascular network, held together by areolar tissue, envelops its exterior. But this is not all. It is insufficient that this capillary network should be brought into contact with the small extent of surface a compact brain would present, and therefore the packing of this viscus is otherwise arranged. It is thrown into convolutions; and into the interstices of every one of these convolutions the pia-mater, as the vascular membrane is named, dips, even to the bottom of each intervening sulcus. Remark the form, variety, and complex arrangement of these convolutions, and thence calculate how extended the superficies of grey matter with which its vascular tunic is brought into contact. And thus is oxygen, that powerful stimulant, especially to nervous force and action,

largely supplied to the dynamic portion of the brain: and thus may we readily account for the syncope or asphyxia which so speedily ensues when the heart's action is enfeebled or suspended on the one hand, or when the respiratory act is imperfectly performed or arrested on the other. And here likewise we have an explanation of the maddening intoxication produced by an excessive supply of oxygen to the brain, as is witnessed in the inhalation of nitrous-oxide gas. It is further worthy of observation that the complex arrangement of the cerebral convolutions increases, *pari passu*, with augmented development of intellect, as we rise in the scale of creation.

One axiom in connexion with the physical constitution of nerves I must mention before I briefly allude to the functions of the nervous centres. It is this: that each ultimate fibril retains its independent individuality from the point of its origin from the brain until it reaches its destination at any distant part of the body, or *vice versâ*. Thus, if the point of a fine needle penetrate the extremity of a finger or toe, a nerve-fibril is pierced, and this cord communicates the impression made upon it to the cerebral centre, running its course throughout, (bound up it is true with thousands of other fibrils, but without admixture with any,) until its message is delivered, and the sensorium is apprised of the lesion. A familiar illustration of a similar arrangement, and for the same obvious purpose, may be now noticed on our railway lines: but here the wires which represent the nerve-fibrils run singly: whereas I believe the internuncial cords of our recently constructed submarine telegraph, are so bound up as to represent more accurately the nerve enveloped in its neurilemma. And is this puncture which I have imagined actually felt in the toe or finger? Assuredly not. The sensation we refer to the seat of injury is really experienced in the brain; a fact which we cannot doubt: as the simple division of the nerve-fibril in any part of its course at once involves the entire loss of sensation to the part which it supplies.

We may speak of the functions of the nervous system as identical with life. I do not mean that all organised structures derive their vitality from the nervous centres; I am

by no means disposed to take this restricted view of life, as an abstract principle: but I intend to say, so important is the part played by the nervous system in superintending the functions of various organs by which life is sustained, that the presence of that influence is almost co-extensive with vitality itself. It is the fundamental basis of those instruments by which we appreciate all that is material around us. All the intricate arrangement of the labarynthic cavity of the ear, all the exquisite telescopic apparatus of the eye, are but supplementary to the real organ of sense, the nerve. Through the medium of the nerve-cords that impulse is conveyed to the muscles by which their contraction is caused: and growth, reproduction, secretion, absorption, decay, are all, more or less, under the control of this pervading and mysterious agent.

What a lesson of humility and modesty does the very mystery of this subtle influence teach us! We trace with delicate touch and curious eye the microscopic details of this system. We would fain pride ourselves upon our acquired knowledge: yet what have we learned? The mere physical characters of the machine, and its wondrous power and effects: but, as regards the association of the two, the *modus operandi* of the source of power, and even what that power may be, and how it is generated, we are entirely in the dark. It is true that many analogies seem to point to electricity as this agent: but, to my apprehension, it is similarity and not identity, that is proved: and the writhing contortions, the staring eye, and gibbering but noiseless lips, and gaping mouth of the still warm corpse, under the influence of this powerful agent, frightful, yea, awful to witness, serve but to exhibit the susceptibility of the nerves to the galvanic stimulus, without demonstrating its identity with nervous influence.

Disease, accident, experiment, have enabled us to associate, with considerable accuracy, the functions of organs with their several controlling centres. Thus, volition and sensation severally emanate from and centre in the cerebral hemispheres. The cerebellum is the centre of co-ordination to the muscular movements. It is true that Gall has here located other functions: but the relative evidence in favour of these

opposing theories is, to my mind, so much in favour of the hypothesis of Flourens, that I do not hesitate to admit its correctness. The acts of respiration and deglutition are specially associated with the medulla oblongata, or commencing portion of the spinal cord. The various phenomena of organic life which, in the aggregate, constitute assimilation, (by which I mean the digestion of the food and its subsequent preparation for introduction into the circulating system, and the processes attending the deposition of new materials or absorption of old,) all these phenomena are more especially under the control of the cyclo-ganglionic centres and nerves, not inaptly denominated by the Germans "the vegetative system." These sources of nervous supply likewise superintend the purely involuntary movements of the heart and digestive organs.

But there are other phenomena exhibited by the muscular system to which no reference has yet been made: I allude to the reflex movements which have their source or centre in the spinal cord. This subject is one of peculiar interest to me: for I recall the time when the great philosopher with whose name this system must ever be associated as its discoverer, was the object of obloquy, and denounced as the propagator of absurd and idle theories: a time when, as a mere youth, I was first honoured by his notice, and when the experiments I witnessed in his company, and the deductions he drew from them, came home with all the force and freshness of simple truth, to which I yielded my unreserved assent. These truths have now prevailed; and the name of Marshall Hall must live as long as Physiology remains a science.

In this the excito-motor system, as its author has named it, a portion—not identified anatomically—of the spinal cord is the source or centre of power; and the internuncial cords pass centripetally and centrifugally between this centre and the skin and muscles. The nerves of sensation convey impressions from the surface of the body, and the resulting influence which emanates, entirely independently of sensation or volition, from the spinal cord, is propagated to the muscles along the motor fibrils. Whether these fibrils are actually identical with those of common sensation and

voluntary motion is not determined ; but it is probable they are so. Thus it is that the ever-recurring respiratory act is performed under the stimulant presence of carbonic acid in the lung ; that the delicate surface of the eye is constantly swept by its protecting lid ; that the act of deglutition—no voluntary effort be it observed—is effected. But this interesting subject is too extended and too attractive, for me to trust myself further than the threshold.

The crowning feature in the complex functions of this wonderful organism is the association of Mind with the encephalic nervous centre. I almost shrink instinctively from touching on so delicate a subject, from launching into speculations where so many have made shipwreck of their Faith. And yet I feel urged not to pass it by unnoticed, being persuaded that candid and open discussion need never be feared where truth is sought, and that it is the best weapon by which to disarm those who are willing to pervert the truth to the establishment of their own unwarrantable conclusions. I shall, therefore, venture a few remarks on the subject, in the hope of placing it in a clearer light before those of my younger hearers who may not yet have given the question much consideration. It may be well, however, first to state that my observations are not intended to apply specially to the *responsible* part of man's nature. It will be perceived that, if the data be correct, the argument sound, and the inference just, in reference to the mental faculties, *a fortiori*, the pure spirituality of the soul is necessarily involved in the conclusion.

Every existence or object endowed with life possesses certain properties or qualities which distinguish it from inanimate matter ; and these properties or qualities imply the co-existence of an appropriate organism. In the lowest grades of the animal kingdom, the functions are simple and so are the organs : as we advance higher in the scale of creation, both the one and the other become more complex. This general statement holds good specially in reference to the nervous system, the development of a certain part of which reaches its maximum in man. All organs have their appropriate functions ; and I may remark that the occasional vicarious performance of these functions, being an

abnormal condition, does not affect the argument ; I say then, all organs have their appropriate functions ; thus, the kidney is not adapted to secrete bile, nor the liver saliva ; neither can the eye hear, nor the ear taste. But, that the liver *must* secrete bile, and that the optic nerve is *exclusively* adapted to receive the impression we call sight, are facts which, *a priori*, we never could have predicated, and which, with all the knowledge we boast, we cannot explain. We have no alternative but to admit that He who made the organ determined its function. Further, in directing attention to the nervous system, we find that it is the controlling agent, as I have already remarked, which presides over and directs organs in the performance of their appropriate functions, whether of sensation and motion, or those of assimilation. But, as all nerves and the centres whence they derive their influence possess a development proportioned to their office and functions, the physiologist is naturally led to associate the one with the other, and to look for the correspondence as necessary. This admission brings us to the fact of the large size of the cerebral lobes in man, and the natural inquiry as to what function may be reasonably allied with them. Demonstrative evidence proves beyond dispute that the size and complexity of the cerebral convolutions increases, *pari passu*, with the expansion of the mental faculties ; and that both attain their maximum in man. Nay, that cerebral development constitutes a measure of relative mental capacity between man and man ; and, *cæteris paribus*, is an almost unerring test. What alternative then, have we, but to associate here, as elsewhere, function and physical development ?

Now we arrive at the second part of the inquiry, viz. : does the particular function of an organ spring necessarily from its organisation ? In one sense it undoubtedly does : thus, we find that secreting organs are provided with blood which is variously distributed, and may be traced to the ultimate plexus where nature has her laboratory, and whence the new product can be followed along its appropriate duct to its destination : but if we inquire further why the liver does not separate urea from the blood, or why the kidney does not abstract biline, or why muscular fibre

should be contractile, we are at a loss for an answer. Here, then, we might take a stand, and assert that such invariable association is itself a law: this, however, would be disputable ground, as our ignorance on the subject is by no means to be accepted as evidence that we have reached the limit of generalisation. Now, therefore, having traced the analogy, let us examine what constitutes the essential distinction between the respective functions of organs generally, and those which I have shown must be admitted to hold an intimate connexion with the lobes of the cerebrum. In the first place, there is this marked contrast; in the former all the phenomena associated with the function are essentially material and appreciable by our senses; whereas, in the latter they appeal only to corresponding faculties in ourselves: in the second place, we know that the former perish, but have an internal conviction, few would be willing to forego, that the latter survive the physical frame, and are identified, as undying attributes, with our immortal spirits.

Thus far, I apprehend, we may proceed safely; and it is in the objector to this last position that we meet the real materialist. But,—if I am unprepared to prove demonstratively to him what does not admit of demonstration, on what rational ground, I would ask, can he claim submission to so unphilosophical a dogma as is embodied in the inference that, because mind is allied with matter, it is *therefore* material, and must, *therefore*, be a necessary consequence of organisation? The fact is, such an argument rests entirely on a pure assumption, and is neither sustained by reason nor countenanced by analogy. The fatal error has its source in mistaking for cause and effect, that which is simply an association adapted to, and essential for, the temporal condition of man: and if we must acknowledge our entire ignorance of why certain physical functions are immutably allied with their respective organs, it surely becomes us to be satisfied with the fact of this simple association as regards the mental faculties, without wandering into the labyrinth of speculation, where the torch of analogy no longer burns to guide us.

This, then, is our creed; mind, by which I mean the

sum of the mental faculties, is necessarily associated with a certain portion of the encephalon, *because* the senses are similarly allied with another part of the encephalic mass ; and I believe that it is through the medium of the senses alone that ideas are first obtained, and that the faculty of conception is awakened. As a necessary consequence, the integrity of the material organ is essential to the due balance and healthy operation of the faculties allied with it : and the moderate development of these faculties requires only a proportionate physical development. But, to go further, and to assert that mind springs from matter, that it is to the brain what the secretions are to the glands, that it is itself an object of sense, and that it dies with the organ with which it has been temporarily associated ; to say all this, which constitutes the creed of the materialist, is at best a pure assumption ; but it further involves a contradiction of terms ; and implies a denial of man's highest claim as a reasonable being ; alike crushing his loftiest aspirations, and paralysing his best and noblest energies.

With these remarks I close my illustrations of the interesting subject, with which I have ventured to engage your attention ; not because my materials fail me, but that I fear your indulgent patience must be well-nigh exhausted.

Need I, gentlemen, point out the moral of all I have said ? If so, I would embody it in the words impiously applied by the Latin poet to his temporal Lord and Master Augustus. But I would address them to a far higher Potentate than the Imperial Roman ; in the confident assurance that He who framed the universe has granted to each one of us the privilege of claiming a personal interest in the eternal truth which they express :

“ Cum tot sustineas et tanta negotia Solus.”

And must all this manifest evidence of contrivance, beautifully perfect, and bespeaking a Designer whose attributes are power, wisdom and goodness : I say, must all this elaborately complex machinery, set at work as it is by the vital principle, of which the mighty power of steam is but a feeble type ; must it all come to an end ? Yes, truly

this material fabric must be dissolved, that its immortal prisoner may be set at liberty. As the caged bird ever and anon spreads her wings, conscious of an untried power to soar aloft, and falls back exhausted by beating in vain against her narrow prison-house ;—so, the undying spirit of man, sensible of its noble destiny, thirsts after higher knowledge, yearns for a purer atmosphere, and seeks to burst forth from its straitened cell, vainly striving after that which is unattainable to flesh and blood ;—until taught patience to await the time when He who raised the tent shall strike it ; in due season to bestow a more durable mansion, infinitely exceeding in beauty and perfection that which we now so much delight to honour ;—a home which is our second birth-right, an eternal freehold in which our interest shall last for ever.

INAUGURAL ADDRESS

DELIVERED AT THE OPENING OF THE MEDICAL SCHOOL
OF ST. THOMAS'S HOSPITAL,

OCTOBER 2ND, 1871.¹

MR. TREASURER,—It is now many years—I do not care to say how many—since I exchanged my school-days for an articulated student's life within the walls of our venerable Hospital. I may even then have indulged in the fond anticipation that, at some long distant future, I might realise the promotion which every Hospital apprentice of my time hoped for, but few attained. Yet I knew that unremitting exertion was needed in this competitive race, and I sought with others the mental relaxation and physical bracing which exercise on our river afforded. We used to come to Stangate; and many a time have I tripped, in the lightness of heart which the young and unwarped spirit alone knows, over the long shelving shore at low water, to launch my boat. Even the ready credulity of boyhood would have rejected, as absurdly improbable, the suggestion that each flood-tide was then covering the site of the Hospital of future ages. Yet it was even so; and I now stand, with mingled feelings of deep emotion, on this spot to inaugurate the first session of a new era in the history of our old and honoured School.

¹ This address was delivered in the Hall of the New Hospital, at the opening of the first Medical Session within its walls, and in the presence of a mixed audience, including former and present students, and the parents and friends of many of the latter. It was printed at the request of some who were present, and of others whom the size of the Hall was insufficient to accommodate on the occasion,

It would ill become me, on an occasion like the present, to yield to those reflections which naturally claim their influence over the mind of one who has passed the meridian of his days. It is the penalty of survivors to lament over the graves of those who are gone before ; and how few of the number who began their career with me still remain, whilst all my honoured teachers have departed. How distant the prospect of the future was long years ago, yet how brief the retrospect. It scarcely needs an effort to carry me back to the time and scenes when, with buoyant hope and earnest purpose, I listened to the words which fell from the lips, and watched the hand-skill, of those I revered—ambitious to tread in their footsteps. Their place knows them no more ; and in paying a passing tribute to their memory, I am reminded that I am now the oldest teacher in this School, and the oldest officer or servant of the Institution ; and I am sensible how closely the next generation is pressing on—how soon I must give place to others ; happy if, perchance, I linger still in the memory of some whose early promise I have hailed, and whose future career I shall continue to watch with abiding interest.

I have been led into this train of reflection by a consciousness that lapse of time has gained for me the privilege of addressing you on this interesting occasion. I shall not, however, indulge myself by giving further expression to meditations in which my younger hearers cannot be expected to sympathise. We are met together to celebrate a new birth ; to inaugurate a new era ; to renew our association with the familiar waters of our old river, from whose banks we have been divorced so long. He will not resent our presence ; for though we have encroached upon his bed, he flows by us with increased vigour, and in a purer and more wholesome current than of yore. All hail to our honoured river, which secures to us immunity from encroachments, and an animated scene and health-giving breezes for our patients.

We have a noble Hospital, and the local habitation of its fitting accompaniment—a great Medical school. To you, Sir Francis Hicks, I offer, on behalf of my colleagues, our congratulations on the completion of this great work, which owes so much to your unflagging energy and devotion ; and

to express, at the same time, our appreciation of the enlightened spirit which has prompted the governors to make such admirable arrangements for the Medical school. I believe, sir—nay, I have no misgiving—that our success will be commensurate with these preparatory advantages, and will leave no room for regret that this impulse has been acted on so liberally.

Although deputed to inaugurate a new era in the history of our Hospital school, I cannot be unmindful that there are many present on this occasion who sympathise with me in the memories of the past; and I may be excused if I devote a few moments to the retrospect. Such indulgence—sentimental if you please so to call it—may not be without its apology, and even its useful application in this utilitarian age.

The dawning history of St. Thomas's Hospital was not such as to promise the vigorous adolescence which it has since attained. It was early in the thirteenth century—viz., in 1207—that an accidental circumstance gave birth to it. The canons of St. Mary Overy were burnt out of house and home, and took refuge in a building, which they erected near at hand, till their monastery was rebuilt; and the subsequent appropriation of this building for charitable purposes is the origin of our Hospital. A few years later, when under the patronage of the Bishop of Winchester, the ruins of whose palace still survive by the riverside in Southwark, it was scantily endowed by him.

The derivation of our name is somewhat obscure. It would appear, however, from the careful researches of Dr. Stone, who has contributed a "Short History of Old St. Thomas's Hospital" to our *Reports*, that the Spital was first dedicated to St. Thomas the Martyr of Canterbury, and afterwards, with more orthodoxy, to St. Thomas the Apostle. The annual income of the Hospital towards the close of the fifteenth century was £343; and this was dispensed by a president, a master and brethren, the foundation being limited in its usefulness, and employed as an alms-house for the needy and infirm to die in, rather than as a refuge wherein the sick and wounded could be made whole. Nurtured thus through a prolonged infancy of more than three centuries, the institution was at last claimed by our orthodox

and excommunicated King Henry VIII, as church property, and was subsequently adopted and endowed by his youthful son Edward, who, shortly before his death, appointed the Lord Mayor and commonalty of the City for the time being as governors in perpetuity of the four royal foundations of St. Thomas, St. Bartholomew, Bridewell, and the Blue-coat School. Under their sheltering wing our Hospital has flourished and been enriched during the succeeding reigns. The old structure survived the great fire of London in 1666, and likewise a succeeding conflagration, ten years later, in Southwark; but towards the close of that century it was replaced by a new building, nearly £40,000 having been subscribed for that purpose; and the statue of Sir Robert Clayton, which still graces our grounds, was then erected in commemoration of his liberal benefactions.

My own early memory of our Hospital dates back to a period prior to the erection of the two noble piles of building which flanked the new front square, in the midst of which the beautiful statue of our Sixth Edward stood; and I used to traverse the old London bridge from my City home, and listen by night, on my return from lecture, to the mysterious music of the waterworks, as the tide rushed through them with deafening noise; and little, indeed, did we then ween of the possibility that any power could arise, of such influence as to compel our removal to another site.

The interval of our abode in our late temporary refuge has been one of partial suspension of animation, and will, doubtless, ere long be regarded as a blank in our existence, when the life we now renew shall be fully established and developed.

In the chronicles of our Hospital there are recorded many curious and interesting facts and events, as well as the names of both Physicians and Surgeons who were not only famous in their own day, but whose reputation has survived to the present time. Amongst the records—for which I am much indebted to our Medical Secretary, Mr. Whitfield—I find references to some singular customs and circumstances, which mark the changes that time has wrought in us and in our establishments. Thus, towards the close of the sixteenth century, inmates of the Hospital of notoriously bad character

were ordered to be punished at the cross erected within its walls, before they were discharged; and we have an actual recital of punishment by whipping at the said cross being inflicted, for misdemeanour, in 1567. We also find that, in 1573, the morals of the patients were further cared for, by a hand-mill being provided for them wherein to grind corn, that they might thus "be kept from idleness." In 1698, Mr. Elton, one of the Surgeons, was suspended from his office for assaulting and beating one of his colleagues; and in consequence thereof an order of the Court of Governors was passed—which, I presume, is still in force—that in future, if any officer strike or beat another officer, he should be expelled.

This was certainly a vulgar way of resenting an offence, and is suggestive of the hybrid character of the barber-chirurgion of that epoch. But it is recorded traditionally that the more polished Physician, whose status in society permitted him to carry a rapier by his side, was also guilty of Professional squabbling, ending in deadly feud; for Mr. Whitfield has in his possession a gold-headed cane which was presented by one of our Medical staff to his grandfather, in recognition of his services in arresting a mortal combat across his table by two Physicians of this establishment.

I find the practice of specialities is recognised in the register of events of 1638, when £20 a year was voted to a Surgeon—I suppose the Wilson of his time—for the special care and cure of scald-head. But the governors of that period showed a wise discretion in another allied act. It is well known that, before the great Cheselden lived and adorned alike the Profession and our Hospital, one of the most terrible diseases to which the human frame is subject was rarely cured, because of the ignorance and incapacity of those who undertook the only means of affording effectual relief by operation. Now, it appears that in the year 1700 a certain Dr. Cypriano, a native of Amsterdam and educated at Utrecht, had acquired a reputation for lithotomy; and the General Court of the Hospital, prompted by a humane feeling, and careful also of the honour of their officers, requested the President to treat with this gentleman, with the view to his instructing two of their Surgeons in his special operation.

It is recorded that on several occasions he performed the operation in question at our Hospital with great success, and without fee or reward ; but we do not learn whether his instructions were serviceable to his two pupils. I should think it doubtful ; for little is learned in a complex operation, almost every step of which is out of sight, and in which an appreciation of all the attendant difficulties can be acquired only from an accurate acquaintance with the anatomy of the parts concerned. But anatomy was not then studied as it now is ; and the benevolent object of the governors would have been more effectually attained had they rescinded an order of the Court issued a short time previously, that “no dead corpse should be dismembered.”

The first impulse in the right direction, in the performance of the operation referred to, was given by a French priest, Frère Jacques, in 1697, who acquired an European fame. But it remained for Cheselden to place it on the sure foundation which I have indicated ; and it is much to say of our great Surgeon, that his work on the subject, published in 1723, deserves to be a text-book still ; and that in every essential particular this operation remains what he left it a century and a half ago. What worthier subject, then, could be found for the sculptor’s chisel, or to be held in cherished remembrance by the old St. Thomas’s students ? And beautiful, as a work of art, is the marble effigy of this fine old English Surgeon which now graces our entrance-hall—the gift of those who delight to honour the great and good associated with their Hospital and School.

At this period of our history a regular registry of the Surgical pupils was kept by the Apothecary, and the useful order of Dressers existed. It may not be uninteresting to the gentlemen now holding that responsible office to learn that they were then called “Cubbs” in our establishment.

I have said that we can boast of many names of celebrity in the annals of our Hospital. Thus, one of our Physicians, Sir Francis Prujean, received special marks of honour at the Court of Charles II, whose queen he attended in a severe attack of fever.

Dr. Richard Mead, whose courtly bust (also the gift of our old students) presents an interesting contrast to the art-

less and almost rude attire of his great Surgical colleague, was an accomplished Physician and a man of letters ; and whilst an officer of our Hospital he condescended to read lectures on Anatomy to the Company of Barber-Surgeons. Engaged in a large and lucrative practice, the Medical attendant of Queen Anne in her last illness, and the Court Physician of George II, we learn that he was “ highly respected, and as the patron and friend of the learned universally admired.”

It is recorded that Cheselden gave lectures on Anatomy and Surgery at the Hospital, but it was not until later—viz., in 1768, that Joseph Else, one of the Surgeons, was officially appointed to lecture ; and it may be said of him that he was the founder of the systematic teaching of Anatomy in St. Thomas’s Hospital.

Dr. Mark Akenside was likewise an accomplished Physician ; and, in addition to being one of the officers of our Hospital, held the highest Court appointment at the commencement of the reign of George III. But his reputation as a poet has survived his professional fame, and there is much of elegance and rhythm in his verses, and his language is choice and classical ; but few can read his “ Pleasures of Imagination ” without some sense of weariness at the pompous and somewhat pedantic diction in which his really beautiful imagery is clothed.

In 1770, Dr. Fordyce, whose portrait we possess, set us an example of diligence which I think few of my colleagues would be disposed to follow. He used to lecture daily on three subjects, viz., Chemistry, Materia Medica, and the Practice of Physic ; and these lectures, given at his own house, were delivered in three successive hours, commencing at seven o’clock in the morning.

The names of the first Lister (whose aged, benevolent face I can just recall) and of Wells (the author of the elegant and conclusive monograph on the “ Formation of Dew”), of Currey, Chandler, and the Clines, bring me to the period of my own personal recollections, when my honoured master, Mr. Travers, with Mr. Green and Mr. Tyrrell, were the Surgeons, and Dr. Williams, Dr. Elliotson, and Dr. Roots were the Physicians of our Hospital. They are all gone, and I can but record the great esteem in which they were held by

all who knew them, as men of high scientific attainments, whose teaching and example have left their impress on the minds of many, scattered throughout the length and breadth of this land. Of my own more immediate contemporaries, some are gone and some still survive, though they have withdrawn from amongst us. The grave has scarcely closed over one ; and many will have learned with grief, but scarcely with surprise, of the death, one short week since, of Samuel Solly. I have known him since my boyhood, and we have been allies and colleagues throughout life ; and I cannot recall a single hour during which the harmony of our intercourse has been interrupted. His compulsory retirement from Professional duties, in consequence of ill-health, occasioned our premature loss of his services here ; and he carried with him the sympathy and kindly feeling of all his colleagues.

I may, perhaps, be permitted to express the excusable pride I feel in having now associated with me many of my former pupils, who have already made a name for themselves in the world of science. In the rising generation, St. Thomas's has no need to be ashamed of her children ; and we both hope and expect she will rear many worthy successors to those I have named.

The last few words I have spoken remind me of the change which has come over the guiding principle of election to the offices of this Hospital, since I was an articulated student. Then an apprenticeship to one of the Surgeons was deemed a necessary first step towards obtaining the appointment of Surgeon to the Hospital ; and I have, naturally, a vivid recollection of all my contemporaries, who were competitors for the coveted promotion. Just as on the racecourse, one by one fell away from various causes, and speculation as to the future was often falsified by the unredeemed promise or inability to stay. He who had the good fortune, as it was mine, to get an early start might hope to win ; but the necessary exertion was arduous and unremitting, for since the age of twenty I have not ceased to take part in the teaching, though not the less a learner, in our Hospital school. I mention this circumstance to exemplify the trying nature of the long probation and deferred promotion which attended this arrangement.

The principle of free choice which now prevails, partly the cause, and in part the consequence, of the comparatively obsolete usage of apprenticeship, carries its own recommendation with it ; yet I am free to admit that my conservatism does not allow me to dismiss this custom of other days without a word of apology for it. If we may judge by results, certainly the reputation of my immediate predecessors and teachers, and of their contemporaries at the sister Hospital, where the same usage prevailed, is some justification of that system. The training of the young men, who claimed their privileges from an apprenticeship of six years at the Hospital, was such as to constitute a special preparation for their future duties, if they were naturally qualified to avail themselves of their peculiar advantages. Living for a lengthened period in the dissecting-room and wards of the Hospital, they could not fail to acquire that familiarity with their after-engagements which no other training could so well supply. Indeed, the change in the practical working of the old system of apprenticeship is not, to my mind, an unmixed advantage. When Practitioners in the country conscientiously performed their duty towards their apprentices, during their more protracted sojourn with them, our students used to come to London already in possession of preliminary information, and what I may term conventional details, in their Profession, which are not so well acquired in our schools.

But times are changed, and with them the rising generation ; and I neither expect nor desire to see a recurrence to the bygone system to which I have referred. Yet I would venture to plead on behalf of the students whom we educate at our school ;—other things being equal, their prior claim to preferment is just and natural, and should never be ignored. In reputation, a Hospital and its school are essentially linked together. The indirect advantages to the public derived from the latter are scarcely subordinate to the benefits directly flowing from the former ; and the fame of a Hospital must ever be commensurate with the reputation of its officers, as trustworthy teachers of the scientific practice of their Profession.

But both teachers and pupils have their special responsibilities, and by their reciprocal fulfilment only can successful

teaching be secured. I believe that the public generally have but a very imperfect appreciation of the complex and extended course of instruction which medical education now embraces; and it is this increasing complexity which continually enhances the difficulty of the problem, that is presented by the necessity of having some definite limit to the acquirements which a qualification to practise demands. It is not given even to the most gifted to become proficient in all the required subjects within the limit of time which is assigned to study; and, therefore, it is obvious that a standard must be adopted which shall supply a numerical sufficiency of qualified Practitioners. Whilst it is my sincere conviction that the College of Surgeons has honestly and faithfully fulfilled its functions, I have hailed with satisfaction, as I have sought to forward by my feeble influence, that scheme of conjoint examination which offers to the candidate one common portal by which he may enter the Profession with a qualification to practise, whilst it leaves to our English colleges and universities the special privilege of conferring honorary degrees, after having exacted proof of more advanced attainments.

I said that teachers have their responsibilities; and, without presuming to dogmatise on this subject, I will briefly indicate the method which my own experience has taught me to regard as the most profitable, if not the most acceptable, mode of imparting professional knowledge. Teaching may be either exhaustive or suggestive. The former method, even if well and fully accomplished, can but instruct the student in facts, and supply him with reasons—good or bad—for the conclusions from these facts. But this is not education, which consists less in supplying the learner with thoughts than in stimulating him to think for himself; for

“ — Knowledge dwells
In heads replete with thoughts of other men;
Wisdom in minds attentive to their own.”

Bishop Butler has remarked that the best writer—and *à fortiori*, I should say the best *vivâ voce* teacher—is he who simply states his premisses, and leaves his readers to work out the conclusions for themselves. It is true that much of our

teaching relates to facts ; but these facts are, or ought to be, associated with principles, and the business of the teacher should be, in my apprehension, to exercise the mind of his pupil to work out for himself the relation between a principle enunciated and the facts by which it is supported. Trituration and digestion are as essential to healthy assimilation by the brain as by the stomach ; and I am disposed fully to concur with an apologist of Coleridge's disjointed style of writing, when he eulogises its highly suggestive character, as contrasted with such exhaustive teaching as alone will satisfy him " who thinks that the epithets *teres atque rotundus* are the highest that can be applied to a scientific work, or who expects an author to furnish him with a complete system, which he can carry away in his memory, and, after it has received a few improvements from himself, may be hawked about to the public or to a set of admiring disciples."

I cannot help lamenting that there is much in the present method of teaching which is subversive of this suggestive principle for which I plead. Circumstances have, no doubt, conduced to this result, and chiefly the multitude of subjects crowding upon the attention of the student, which create a demand for the supply of information in such a form that it can be appropriated by an exercise of memory, without the invigorating effort which suggestive teaching stimulates. The results of such mechanical learning are not satisfactory, and the stereotyped acquirements of our students have induced the examining bodies wisely to modify their examinations, by rendering them as practical as possible, in order that the possession and exercise of a retentive memory may not be the chief qualification on which a student can rely for obtaining his diploma.

If, then, it be the duty of the teacher to stimulate the student to think for himself, it is no less incumbent on the latter to cultivate a spirit of self-reliance in learning his Profession. He must, in short, educate himself, with the assistance and direction he will obtain from his teachers ; and he will find that an infusion of enthusiasm into his work will impart a pleasurable life and activity to the laborious details of his scientific pursuits, and render attractive that which would be otherwise irksome or repulsive in his studies.

I would now address a few words to those especially who are about to commence their Hospital career. Your sojourn amongst us is fraught with momentous consequences to you, both moral and intellectual. The new life you enter upon, and the new scenes you become conversant with, must leave their lasting impress on you for good or evil. Familiarity with suffering and death, in all their varieties and forms, constitutes a school of moral training which cannot fail to refine or to debase the moral sense, to strengthen or to enervate the character. Your future career will afford ample opportunity for applying the lessons of sympathy here inculcated, and of patient forbearance and gentleness in your relation with the sick and sorrowing, with whom so much of your life will necessarily be spent. These are grave responsibilities which will be yours, the importance of which you cannot too soon realise; confidence of the most sacred character entrusted to your keeping, and opportunities for good beside and beyond your mere Professional duties; from availing yourselves of which, no false humility, no mistaken apprehension, should tempt you to shrink; and which you cannot evade without a compromise of truth, if you indulge the restless hope of restored health or prolonged life when you know that hope is vain. It is unnecessary I should pursue this subject further. If you obey the promptings of your better nature, and speak the truth with gentleness and candour, you will have your reward in peace of conscience; whilst it is beyond your ability to estimate the consequences to the dying sufferer who hangs upon your lips.

If I have paused to point out these as some of the moral lessons to be studied here, it is scarcely requisite that I should dwell on the necessity of improving every opportunity of mental culture now placed within your reach. The book of nature is spread out before you in the dissecting-room, the laboratory, the wards, the museum; its pages are to be supplemented—not superseded—by the teaching and recorded opinions of other interpreters of the great original. Drink deeply at the fountain-head, and gradually each new phenomenon or insulated fact will assume its true relation to others, as you view them, blending harmoniously, and acting under laws alike grand in their conception and simple and

uniform in their operation, and thus bearing the impress of the Infinite intelligence and goodness which planned them. It is thus, I venture to believe, that you will best cultivate the self-reliance and freedom from the slavery of authority, which are such essential qualifications for philosophical inquiry, and which are quite consistent with—indeed, ought to be the offspring of—true humility: for that independence of character which has taught its possessor to scorn servile imitation, and to bow obsequiously to no man's dictum, should prompt him likewise to follow meekly the steady light of Truth, and to be the ever-ready servant and interpreter of Nature. I do not say your path is easy; but you may make it pleasant by opening wide your heart in sympathy with your fellow-men, and by cultivating your Profession in an enlarged and philosophic spirit, instead of resting satisfied with the minimum of knowledge as your trading capital, acquired only for the pecuniary return it promises. You owe this to the noble calling you are about to follow; for though I am aware that it has been said—and, I fear, with some truth in its application to the present time—that the “age of chivalry is gone, and that of sophisters, economists, and calculators has succeeded,” yet is my faith unshaken in the elevating tone and influence of scientific pursuits, and in the full though long delayed recognition of their claims, at length forced on the promoters of public education; unshaken, also, in the manly sentiment and independent principle which pervade the mass of my Profession.

A few words more of personal application I am constrained to speak to my younger hearers, who will bear with me if their triteness deprives them of their relish. Most of you must be aware that your sojourn amongst us entails sacrifices on those who have sent you here—sacrifice in the anxiety consequent on your being thrown alone amid all the temptations, frivolities, and dissipation of this great city, and a pecuniary sacrifice for your best and permanent interest. Confidence is placed in your redeeming the tacit or spoken pledge of honest and upright conduct. Will you abuse and betray that trust? Yet wasted time and misemployed talents, and the indulgence of low tastes and vicious habits, will be

such betrayal, and bring grief and disappointment in return for self-denying love.

In fulfilling your obligations I would simply ask you to be manly ; and I will tell you briefly my interpretation of that comprehensive word. I should be untrue to my own instincts and to the position I occupy as President of the United Hospital Athletic Club, if I did not bid you cultivate manly exercise and sport. I admire the strong arm, the swift foot, and the bold bearing of the athlete ; yet these pastimes must be your recreation, not your occupation. But there is a higher phase of manliness to which I especially refer. It is manly to be severe with yourselves and to deal lightly with the failings of your fellow-men. It is manly to admit rather than to justify either ignorance or error. Self-sacrifice is manly ; but there is no element of manliness in the untruthful, the selfish and the impure mind. It is both gentle and manly to esteem others better than yourselves ; and to claim the respect which is your due, by that courteous consideration for all around you which never fails to characterise the true gentleman. Above and beyond all, if you value your Bible, it is manly to avow it ; and, by patient endurance of contradiction and consistency of conduct, to prove that your faith is a real and living principle, regulating primarily your own deportment, and thus influencing your relations to all with whom you are associated.

“ To thine own self be true,
And it will follow as the night the day,
Thou cans't not then be false to any man.”

But it is time that I bring to a close my brief tribute to the memory of the past, and the vindication of my confident hope in the future, of our ancient and royal foundation.

Once the refuge of a few obscure monks—now re-opened amid the pomp and glittering pageantry of State officials, and graced by the presence of the noble and gentle in the land, and of our beloved Queen who sympathises in the early interest the good Prince Albert took in our future home ; nurtured erst in poverty, and restricted in usefulness—now possessed of a princely income, and folding within her wide-spread arms the destitute sick and maimed, whose only pass-

port is suffering and want ; yielding formerly her pittance of empirical skill and nursing to the few who sought it—now rich in the memory of so many whose labours within her walls have indelibly allied their names with some of the most enduring achievements of Medical science ; and (shall I not add ?) proud of association with the imperishable name and work of the self-denying and gentle Nightingale.

Such, in brief, is the history of this noble institution, and such are the children she has nurtured, who have repaid her fostering care by shedding a lasting lustre on our Profession.

And what is the moral to be laid to heart from this history and these names ? Shall *we* shrink in timid indolence from sustaining the weight of reputation thus transmitted to us ? Shall we plead, with deprecating humility, that “ there were giants in those days,” and sit down in listless indifference beneath the laurels they planted ? Nay ; not so. Let each and every associate in the work, with unselfish and untiring energy, devote himself to his allotted task. Let the substantial token of our affection for our *Alma Mater*, placed within her chapel walls, be the pledge and symbol of that harmony of action for the common weal, which no jarring note of discord shall disturb.¹ Let private advantage and individual preferment ever yield, as in truth and honesty they should, to the fulfilment of the sacred trust to which every officer of this establishment is pledged when he takes office here. Let this be done earnestly, heartily ;—I speak, Sir, as one who has journeyed through weary years of discouragement, and is permitted, by grace and not by right, to tread a few steps within the boundary of the Promised Land ;—let this, I say, be done earnestly and heartily, and who shall gainsay the confident anticipation which it may be, perchance, my happiness to witness, though not to share in, that our ancient foundation, both Hospital and School, shall emerge from its temporary eclipse, to shine with more than pristine brightness ?

And, standing thus on this border-land, once more beside the old, familiar river, from whose slimy bed this stately edifice has risen as if by magic ; surrounded, too, by my trusted colleagues, and by many familiar faces which remind

¹ The chapel organ, the gift of the Medical Staff.

me of our earlier and happy association as pupil and teacher, —imagination portrays for me, without an effort, the expanding vista of an illustrious future, worthy of such a history and such a habitation.

INTRODUCTORY ADDRESS.

DELIVERED AT ST. THOMAS'S HOSPITAL, OCTOBER 1st, 1883.

DEDICATED TO THE STUDENTS AT ST. THOMAS'S HOSPITAL,
WITH THE EARNEST WISHES OF AN OLD TEACHER
FOR THEIR HIGHEST WELFARE.

MR. DEAN AND GENTLEMEN,

When requested, after the lapse of some years, to assume once more the ere-while familiar privilege of delivering the customary address at the inauguration of a new Session, I asked myself this question : What can an old man, who has made his bow and retired from the stage, say, that can interest the young and ardent spirits which are embodied in the students now beginning their professional career ? The aged are apt to be sententious and prosy ; to give advice dogmatically, which is esteemed in an inverse ratio to its goodness, and finally, to be voted bores and pronounced unsympathetic.

But need there be a lack of sympathy between us ? I think not. It is true that the happiness and sorrows and anxieties of old age are derived from sources which *you* cannot be expected to appreciate. It is out of your power to anticipate the future ; but it requires no arduous effort for me to efface the half century which separates us, and to recall, in all their freshness, the confident and hopeful feelings which now inspire you. I esteem this ability to sympathise with the young a precious privilege of age ; and to cherish this capacity is the best way to grow old gracefully. But let me not be misunderstood as referring to such as ape

juvenile manners and habits, as if they were ashamed of their years, and thus render themselves ridiculous and contemptible. I speak of those who can feel for the trials, and rejoice in, and do their best to promote, all the legitimate enjoyments of youth; without regarding with a cynical eye the foibles and shortcomings which they have themselves experienced; ever ready to stretch forth a helping hand or to proffer a timely warning; and thus to win by practical sympathy, instead of wounding and repelling by harsh censure and condemnation.

It is in this spirit that I desire to address you: I would ask you, for the nonce, to regard me as one of yourselves, with the advantage of grey hairs and some experience, whilst I speak to you briefly about your future prospects, and the way in which you may best realise what I take it for granted are your aspirations.

On the threshold I would remind you that it is on no unstable foundation we are called upon to build; in every branch of your studies you may have the restful feeling that it is no *ignis fatuus* you are pursuing, no fallacies of Man's creation you are striving to unravel, but the eternal and infallible Laws of Nature.

Now, it is to these laws in relation to yourselves that I propose to direct your attention in the first place; I will then endeavour to point out to you what share your own Will may and ought to have in accomplishing the life-work before you.

The physical and Natural Sciences are those which will chiefly occupy your attention, and their study will afford you an unfailing and ever expanding resource of pleasurable satisfaction, if you will but try to acquire an early habit of taking this view of your work. I know that, with examinations looming in the distance—and they are more numerous and difficult than when I was a student—it is hard to regard work in any other light than as irksome; yet I feel that, if I were beginning again, I would strive to cherish this habit as the best way of lightening the burden.

Nature has been very bountiful to you in endowing you with capacity to study and appreciate her works; and in the exercise of that faculty the most common things assume

an interest which the heedless pass by unnoticed ; this interest consists in the interpretation of natural phenomena—the association between cause and effect. I can well remember the impression that my earliest acquaintance with Physical Science made on myself ; the pleasureable sense of being able to go—if I may so express it—to the fountain-head for information, and to interpret for myself instead of seeking for explanation from others. This knowledge is easily attained by all ; for a profound acquaintance with Physics, however desirable, is not essential for the purpose of which I am speaking ; and you will have but scant excuse, in this school, if you neglect the rare opportunities afforded you of acquiring all you need, in the Lecture-room and Laboratory of a master of his subject.

All the Natural Sciences are within your reach ; many you will be required to study ; and your taste may induce you to cultivate, more especially, some one in preference to the others ; it may be Physiology, it may be Botany or Geology or Zoology ; whichever it be I advise you to make your selection early ; and never, even in the most busy times of your after-life to let it go. It will be the best recreation you can have during your work, a substantial solace in trouble, and a healthful occupation for your mind, amid the worries and perplexities which must at times beset your path, however favoured you may be in your professional surroundings : and if you be spared to realise the hoped-for rest from compulsory toil, you will possess a resource from helpless indolence, which, in less favoured callings than our own, so often suffices to mar the enjoyment of leisure, to neutralise the advantages of wealth, and to embitter and even curtail the closing years of their envied possessor. Indeed, I would urge you to cherish a simple love of Nature in all her varied phases ; for it is a taste that, amid the severer duties of life, requires nursing. The fields and flowers, the forest shade, the sky, and clouds and ocean ;

“ The stars of heaven,
The deep blue noon of night, lit by an orb
Which looks a spirit or a spirit's world—
The hues of twilight ; the sun's gorgeous coming,
His setting indescribable.”

All these are things of beauty, and may be made a joy, a purifying joy, for ever. Yes, Nature is lovely, and no less loving and grateful ; for she will repay you richly when you are old and your work is done, in an ever-increasing appreciation of the rich banquet which never satiates nor wearies.

Then there is one further good wherein you will be profited by an intelligent intercourse with Nature ; you will learn to trust her. In the practice of your Profession this trust will ripen, year by year, into a more perfect confidence. I again speak of my own experience ; and I do not know of any more valuable lesson that advancing years have brought with them, than a growing faith in Nature's resources in dealing with disease. This seems a simple lesson ; yet observation has taught me that it is not so. Nature does not like to be opposed ; and opposition generally stimulates resistance. It is a life-long lesson to learn how Nature treats disease ; and many are the rebuffs we get until, by assiduous and unassuming watchfulness, we interpret her action, and humbly seek to be taken into her confidence, that we may work together ; for Nature is as beneficent as she is bountiful ; as grateful for help as she is resentful when thwarted.

But there are other laws with which you come in contact, and which influence your life for good or evil most vitally, in proportion as you attend to or neglect their relation to yourselves. I speak of the moral laws, the study of which is too often disregarded in the absorbing claims of external objects of sense. Now, I am not proposing to read you a lecture in Moral Philosophy, but simply to remind you that Man's intellectual and moral nature are not identical ; that the one may be in active exercise, whilst the other is in abeyance ; nay, that cultivated mental gifts may be—and too often are—employed to contravene and subvert the moral law within. In a well-regulated mind the two work together in unison ; and it is this combined harmony and activity of his moral and mental faculties which characterise man's highest development. The prostitution of mental gifts and acquirements to purposes, at once selfish and ignoble, is violence done to the moral principle, the Conscience, and its repetition defiles the moral perception ; and terrible is the condition of him, in whom that inward monitor is corrupted or lulled to rest.

These remarks lead naturally to the consideration of that potent instrument by which we regulate our actions in obedience to the dictates of conscience and a sense of duty, or to the promptings of our wishes and affections. In what way or degree can and ought your Will to regulate your conduct? This must be in accordance with the moral principles which determine the action of the will. To put the proposition interrogatively, in simple and homely language, is your will to be governed by your inclination, whatever that may be, or by a sense of that which is your duty? I am aware that I am asking a trite question; but its very familiarity is the cause of its being so often overlooked; and the inquiry is one which comprehends the essence of moral and mental culture. I venture, therefore, to press home this self-examination as the essential discipline of your daily life; and if you elect to sacrifice inclination wherever it is at variance with your conscientious judgment of what is right, then your will may be freely exercised; and assuredly, if your principles are sound, for good.

Permit me now to direct your attention to a few elementary points in which the agency of the Will is so important in mental and moral culture. We have the voluntary power of controlling our thoughts. Should they be allowed to wander whither they please, or shall we compel them to be in subjection to our will; and, if thus subject, shall that will misguide them? We know, on high authority as well as from experience, what proceeds out of the heart; what is emotionally begotten, and nursed by thought; so, let me earnestly press on you the cultivation of an early and assiduous habit of controlling your thoughts. In mental culture this is as essential as in moral discipline. Of what service can it be to you to sit for hour after hour in the lecture room, if your thoughts are allowed to wander, uncontrolled, to other subjects? What benefit can you derive from the book you are reading if some other subject is engaging your attention? Of what avail will be the instruction imparted at the bedside, if you are chatting idly whilst the clinical lesson is given? Now is the time for the exercise of this self-control; and if it be neglected in early life, it will probably never be acquired.

I have spoken of the half century which has elapsed since I was a student, and which separates you and me. Doubtless this seems to you an indefinite time ; sufficient for many spare hours to be frivolously wasted, and ample opportunity to redeem the past which has been lost. A classical friend of mine once suggested to me a suitable motto for a time-piece which stands in my library : it is this : “*Pereunt et imputantur.*” What a moral lesson there is in these three words ! One by one the moments pass away, and we shall have to give an account of them.

I do not now speak of your higher responsibility, but that which you owe to yourselves and to your fellow-men. The fifty years of which I speak are, in the retrospect, but a brief span, but as a tale that is told ; yet of all that long period I recall the first half-dozen years, as the most important. Seek counsel, if you will, of any one of your friends who is already launched in the active work of professional life, and he will tell you, if he be a true man, that failure to avail yourselves of the opportunities your Hospital life affords will *never* be redeemed. Here there is an occasion for the exercise of your Will, in a determination that no such life-long regret—I may almost call it remorse—shall embitter your future career ; and shall cast its darkening shadow on a path, which should be brightened by a consciousness that you have done your best to merit the confidence of those who seek your aid and trust you.

But, it may be urged by some, the effort is great, the goal is far to reach ; there are so many obstacles in the way that beset my path. Did you ever, in the early morning of a summer’s day, go forth equipped for a long day’s walk, and gaze at the distant hills you must cross before sunset ? Tell me, whether, in reliance on your youthful vigour and endurance, such thoughts have damped your ardour and enjoyment when you started on your journey ? I trow not. So it is, step by step and not at one bound, that knowledge is acquired, and each step brings you nearer, though almost imperceptibly, to your destination. Again others may plead that they have not the ability of their fellow-students. I will not tell such—for all know it—the fable of the tortoise and the hare : but I may remind them of a definition—I think

it is Carlyle's—of genius, as a “transcendent capacity for taking trouble.” Assuredly without some share of such capacity any natural endowment must be greatly wasted ; and with it even very modest abilities have achieved and may accomplish much.

Thus, you will see, if you have followed me, that your Will is the unfettered instrument by which your conduct must be regulated, and your future usefulness, and consequently your happiness must be determined. And in this freedom lies the responsibility ; for the will is but the exponent of the motives and impulses which control and decide our actions. Bishop Bulter has truly said, “ we have the rule of right within ; all that is wanting is that we honestly attend to it.” You know this is so ; your young and unwarped hearts respond to this truth ; but woe to him who stifles this inward monitor, and lends himself a willing slave to the suggestions of his baser passions.

I am well aware you have much to learn and that much is required of you in the short period devoted to your studies. This is a necessary consequence of the rapid strides of science in these later days ; and I deplore one result of this needful storing of the mind with so many facts, that education in its highest sense, is neglected. It appears to me that the contrast between Instruction and Education corresponds with that which exists between Knowledge and Wisdom. You may be a diligent accumulator of facts without being wise in their appropriation and use ; so you may be instructed in many things, without that discipline of the intellect, which tempers the instrument and fits it for any use to which it may be applied. Let me ask you to remember this when you are tempted to acquire knowledge by artificial helps, or in an unmeaning and mechanical way. Seek rather to make the acquirement your own by investigating all its relations ; and do not accept, on the authority of another, that which is within your reach to ascertain for yourself. The best learning is won by self-teaching.

To enforce what I have been saying I must ask you to bear with me, whilst I quote and apply an aphorism, which is, I trust, familiar to you all : it is this : “ What thy

hand findeth to do, do it with thy might:" or to put it in the form of our homely English maxim, "What is worth doing at all, is worth doing well." Observe what this implies: first the election of what our judgment approves as eligible and worthy of the time bestowed on it; and then the earnest performance. This counsel forbids a loose and slipshod way of doing anything; it condemns desultory work and reading, or discursive study without reflection; while it inculcates a high moral tone to guide the judgment, and both method and zeal in employing the agency of the will. A potent factor for good or evil is this Earnestness; alike the sustaining quality by which the holiest and noblest deeds have been achieved, and the fostering nurse of the most wide-spread and debasing crimes. With earnestness of purpose few things are impossible; without it there is ever a lion in the path; and many a gifted mind has, for lack of this quality, been fruitless: noble purposes have proved abortive, until the gloom of night closes around a wasted life "of lavished hours and love misspent," and the buried talent is required by Him who gave it.

There is yet another lesson which this maxim seems to me capable of implying; and that is, thoughtful consideration in all your relations in life. To disregard that which courtesy exacts is unbecoming the chivalry of an educated gentleman: to neglect graver duties from thoughtlessness bespeaks an indolent and selfish disposition. Thoughtlessness is an ignoble apology for selfishness, however venial it may appear; for

" Evil is wrought by want of thought
As well as by want of heart."

But, I fancy I can hear some of you exclaiming "How will all this good advice help us in our examinations?" Aye! there's the rub. I wish, and yet I know how vain is the wish, that you could work without these limits to your aspirations: and perhaps I may help you by telling you something of my long experience as an examiner as well as teacher, the one I may venture to affirm a necessary preparation for the other. But do not suppose I am going to let you into any of the secrets of our Order;

and for this simple reason that there are none to tell. This however, I may venture to say, that, in practical subjects, your Examiner's first object is to ascertain whether you have fairly used the opportunities you have had of learning the *principles* of your profession, and that you possess an *intelligent* acquaintance with those details which clinical observation and instruction have supplied.

The tact and ability of an examiner consists in this diagnosis—to use a familiar expression—of the candidate's capacity; and if satisfied on these essential points venial errors are overlooked. I know that those who are unsuccessful think otherwise: but we are all apt to explain, in our own way, the cause of failure in whatever we undertake; and not infrequently to believe that there has been some hardship, if not unfairness, in our treatment: yet it is very rarely that I have heard complaint from those who succeed. Accidental injustice is almost inseparable from examinations: there are so many disturbing elements at work; but I think the exceptions are rare—at any rate at the College of Surgeons where I have had most experience—that the well-informed candidate has been rejected, and the idle or ignorant man passed. If your self-reliance is due to a consciousness of having worked steadily and improved your opportunities, you need not fear those bugbears, the Examiners. Their duty is a responsible one; for whilst they ought to make due allowance for the short-comings of those whose means of acquiring knowledge have been so limited compared with their own, they also have the solemn duty of protecting the public from the intrusion of unqualified guardians of their health and lives.

Now let me turn to a more congenial subject, our old and honoured Hospital; the nursery of my professional boyhood, and my professional home for well-nigh half a century. Say, you who have spent but a short time here whether you do not identify its honour and its fame with your own: and can you wonder that I feel an undying interest in all that concerns its reputation and success? How my heart glowed when I listened in June to the eloquent and well-merited tribute paid by your Dean to the excellent conduct and

earnest work of the most gifted amongst you : and when I heard him enumerate the many golden trophies won by our students in the wider field of general competition, I almost wished myself young again, that I might put my lance in rest, and once more try a tilt in the field of chivalric emulation. And do not think that I despise the trophy of strength and skill which adorns our Hall. It is emblematic as well as honourable ; for I regard manly exercise as a *Shield* against the temptation of debasing pastimes and pleasures ; a very wholesome outlet for the exuberance of youthful vigour in the hours of relaxation. Not only so : he who plays well can and ought to work well ; for the mainspring in both is earnestness. In these athletic sports you also have my sympathy.

But there is a time for all things ; a time for honourable strife, and a time for repose when the battle of professional life has been fought, and we rest to contemplate our own past in its true perspective. In this review there is much that, in the experience of each, must ever remain veiled from earthly gaze : yet I may venture to glance at the varying fortunes of our School since I first became a Hospital apprentice. The names of my Teachers are but historical reminiscences with you. There were giants in those days. My own honoured master, Travers, and also Green and Elliotson must long survive in the annals of our Hospital. And shall I speak less warmly of my own immediate colleagues ; of Barker and Bennett, of Solly and Grainger, of Simon and Peacock and Murchison ? I feel that I am a link even with an earlier generation, when I tell you that I heard Abernethy and Astley Cooper and even the venerable Blumenbach lecture. I am sure I shall have your sympathy when I speak with pride of those on whom the mantle of their predecessors has so worthily fallen, for many of them were my own pupils ; and I may be justly proud when I enumerate in the long list, the names of Clapton, Bristow, Ord and Stone, of Wagstaffe, Gervis, Cory, Sydney Jones, and Croft and Anderson, amongst those whom I had a humble share in preparing for their responsible duties and distinguished career. Not only is it with pride and satisfaction that I contemplate their honourable and well-earned

reputation, but with a paternal interest, which I feel, and hereby acknowledge, is reciprocated in their filial invitation, which brings me among you to-day; a pledge of that mutual trust and friendship which time has served only to strengthen.

I have spoken of the vicissitudes of our School within my memory, and they have been many. The separation of St. Thomas's from Guy's occurred in the year before I joined; and the prestige of Sir Astley Cooper's name drew many to the latter school, whilst the unrivalled eloquence of Joseph Henry Green, then in his prime, was the chief attraction to our own. Party feeling at first ran high, but was succeeded by an honourable rivalry. Then came at length the long-threatened expulsion from our old home, and a period of partially suspended animation followed the infliction of this blow, until new life and vigour were infused into our old Institution, when it arose once more on its existing site, and on its present enlarged scale. How many, too, are the changes which have been introduced into the practice of Medicine and Surgery during the period to which I refer. It was then the Dresser's duty to follow the Physician in his rounds, with a bundle of bleeding orders in his hand; and he never hesitated to comply with the constantly recurring request of casualty patients to be bled, and for no better reason than that they were accustomed to it: whereas now, many Candidates for our College diploma have manifested, in their examination, an utter ignorance of how to prepare the arm or use the lancet. To what is this change due? It cannot be simply caprice or variation of fashion in the treatment of disease: a change must have come over the phases of pathology, or, still more probably, from some unknown cause, over the temperament and proclivities of the population. Popular prejudice runs high against the beneficent influence of vaccination; and to make a seton or a moxa now would almost subject a practitioner to indictment for manslaughter, so exaggerated is the apprehension of blood poisoning, and the dread of bacilli and their congeners.

In Surgery, courage and conservatism—wholesome allies—have done much in promoting its progress. I remember Baron Heurteloup exhibiting his clumsy apparatus in our

operating Theatre to show that it was *possible* to break a stone in the bladder; and now lithotomy, in its present perfected form, is an everyday operation in the hands of the many. Joints are excised and many limbs thus saved. Bloodless and painless operations are performed, however tedious. Aneurism is cured, where mechanically practicable, by simple pressure or the flexion of a limb. In dislocation, blood-letting and pulleys have yielded to the gentle—I had almost said elegant—manipulation by which reduction may now be generally accomplished. In this brief survey I must not omit the triumphs of abdominal surgery, due so largely to one who owes allegiance to St. Thomas's as his Alma Mater; but lately the President of the College of Surgeons, and now Sir Spencer Wells.

And here, perhaps, I might close this brief address, but that, without an explanation, some things which I have said might be misapprehended, or might not convey the full meaning I desire to attach to them. I have spoken to you of Nature and Law, of Free Will and of Responsibility. The word "Nature" is sometimes used as signifying an inherent or self-generative power in matter, without intelligent agency. Such is not my meaning. That is natural in the material world which accords with, and is determined by, the Laws by which matter is impressed and influenced. But what is Law as applied to matter? I do not accept the hard and chilling definition of this word, that it signifies "only the ascertained sequence of events." To my mind law signifies more than this: it implies a causative and intelligent agent, in short a Law-giver, beneficent and omnipotent,

"Too wise to err, too good to be unkind."

If intelligence has not framed these laws, where else are we to look for an explanation of the uniformity of their action and of their mutually adjusted government of matter, with all the grand and glorious outcome which we have within and around us?

Permit me to take the opportunity which these thoughts suggest of saying to those who are about to join us, that some of your fellow-students meet periodically, for mutual

assistance in those things which concern their highest interest, and constitute the only safeguard against a cold and heartless scepticism, which our Profession has been so unjustly charged with fostering.

I have glanced at some of the changes which illustrate the progress of Medical Science and treatment within my memory. Not less striking are those which distinguish the march of Biology and Physics. The theory of Evolution is no longer the peculiar property of the specially instructed ; but every amateur in natural science, however crude his knowledge, considers himself competent to give an opinion on this attractive doctrine. Yet it has required more than a generation to develop, and will take more than another to verify or disprove its assumptions.

In Physical Science, Force has been stamped with the same imperishable character as Matter. Thus are we ever pressing onward and upward ; from details to principles ; classifying what we used to regard as final under a higher and more comprehensive law. The elements of our Material world are many ; but the forces by which they are acted on are few. What if the correlation and convertibility of those few should signify identity, with only different phases to adapt them to their respective offices ? Be that as it may, generalisation is ever bringing us nearer to the Source of all ; our life, our active agency, our being. Shall we shrink back and deny our Creator in this approach ? Shall we thus abuse the liberty of Freewill and thus disclaim our responsibility ? Such as are disposed to be thus wilful or negligent whilst they are young, vigorous and self-reliant, should remember that the time will come when these gifts must wane ; and in their lonely hours the phantoms of the past will flit before them, and recall the wasted opportunities and misused talents, the self-seeking at the cost of others, the suppression of better impulses, and the sacrifice of duty at the shrine of inclination. But I anticipate better things of you. Grapple with your enemy in whatever form he may present himself ; and do not limit your aspirations to securing your own happiness and the acquirement of knowledge ; but seek rather to realise the still higher and more noble purpose of your existence, in

promoting the good of others, and in becoming masters of yourselves.

When I took leave of my Class more than ten years since, I little deemed it would be my privilege to address another that knows me not. Yet so it has fallen out. To many of you my introduction will also be my farewell. I therefore feel constrained to remind you that each one of us has his appointed task, whether great or small, assigned to him by a loving Father, who regards the Will rather than the capacity or the result, and whose judgment cannot err. Be strong, then, and quit you like men ; and may God speed you on your way. If that way be rough and toilsome, still patiently press on ; and when the lengthening shadows tell of the coming night, and the fleeting things of time and sense grow dim, may your spiritual vision brighten, and your faith wax stronger in the unseen realities of another dawn, which shall usher in the Sabbath of your lasting rest.

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